MACHINERY

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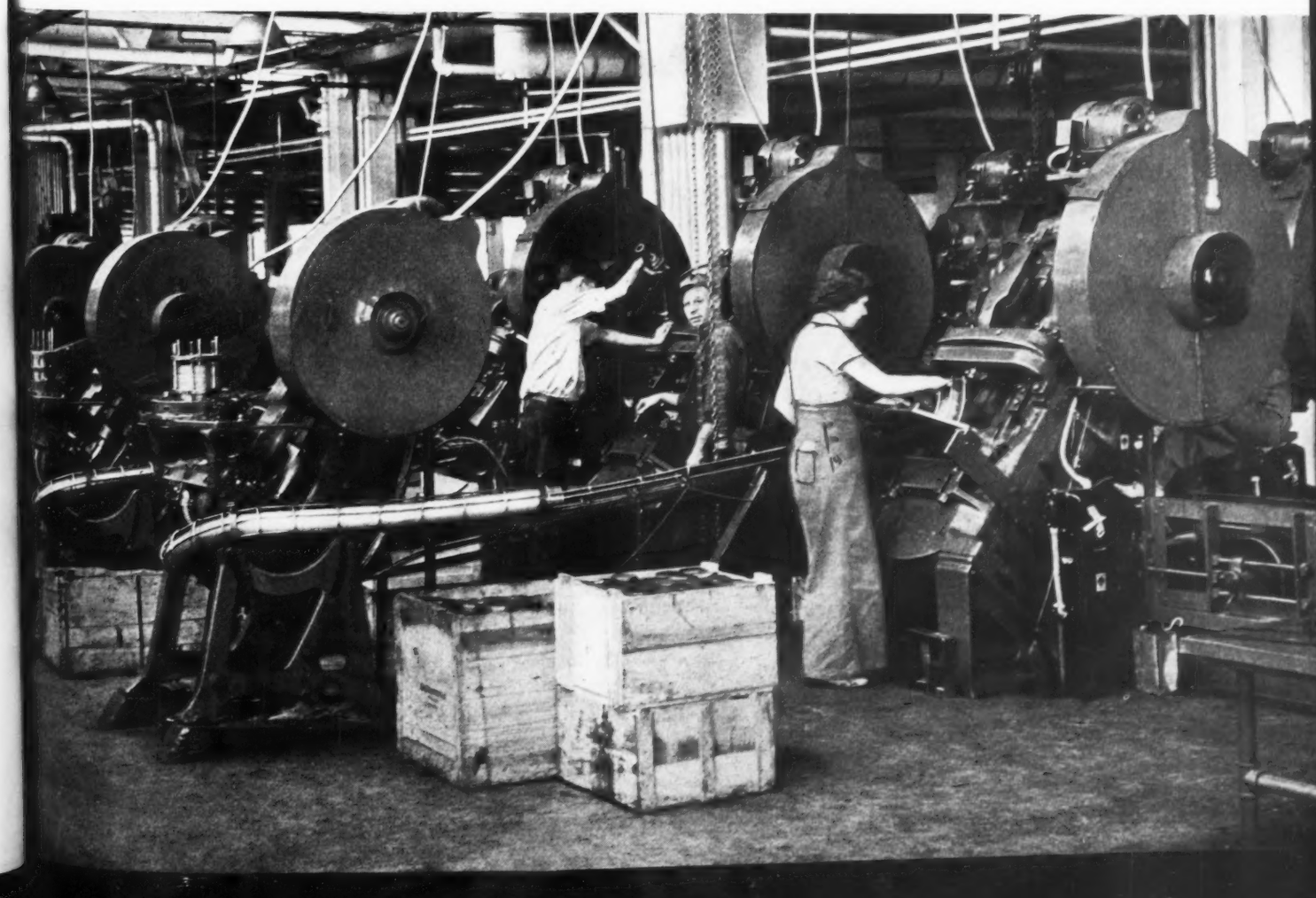
Automatic Work-Handling in a Stamping Department

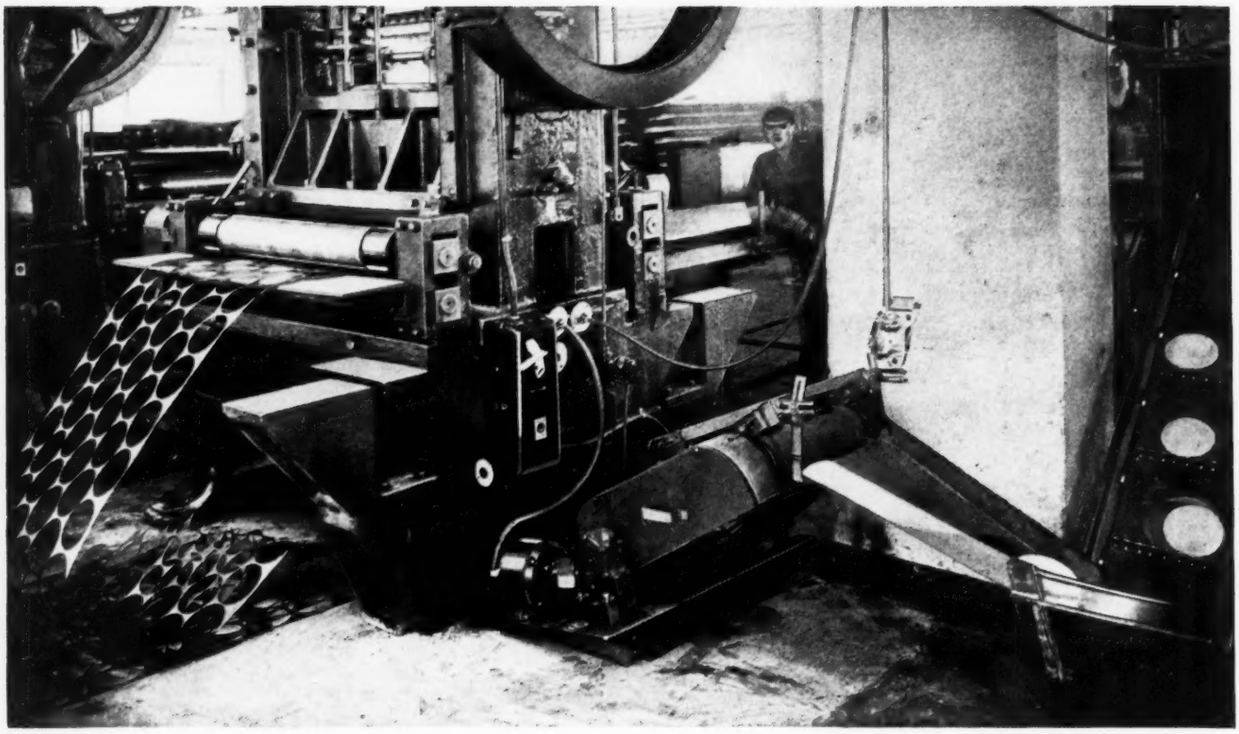
Conveyors Catch Blanked Motor Laminations as They Drop from the Dies and Carry Them Directly to a Second Press Operation and to Sorting and Stacking Machines

By *CHARLES O. HERB*

WHEN the fractional-horsepower motors plant of the Westinghouse Electric & Mfg. Co. was established at Lima, Ohio, in 1936, the engineers responsible for planning the manufacturing facilities had the advantage of drawing upon the wide experience of the other plants in the organization that were also engaged in electric motor manufacture. Practices that had proved best for attaining certain ends could be adopted and supplemented with facilities that were feasible in arranging the new plant but that might not be possible in established plants, due to the impracticability of relocating machines, the expense involved, and other factors.

The result has been a new plant equipped for the uninterrupted flow of work from raw materials to finished motors with a minimum of manual work-handling and utmost dispatch. One of the model





departments in this respect is that engaged in the blanking of rotor and stator laminations. Batteries of machines in this department are connected by conveyors which catch the stampings as they fall from the press dies and carry them directly to the machines on which subsequent blanking, sorting, and stacking operations are performed.

Blanking Disks of Sheet Metal from which the Stator and Rotor Laminations are Produced

The stator and rotor laminations, as in standard practice, are produced from blanks of the same diameter as the outside of the finished stator lamination. These blanks are produced six at a time in heavy presses such as seen in Fig. 1, which operate at the rate of ninety strokes a minute, giving a production of approximately nine blanks a second.

Before the steel sheets come to these blanking presses, they are passed between felt rolls which spread a thin colorless enamel over both sides. They are then carried automatically through a long oven which bakes the enamel. This enamel serves the dual purpose of a die lubricant in the manufacturing operations and as an insulation against magnetic flux to reduce eddy currents in the finished motor.

The blanks produced in the operation shown in Fig. 1 fall from the die into a pit in the floor,

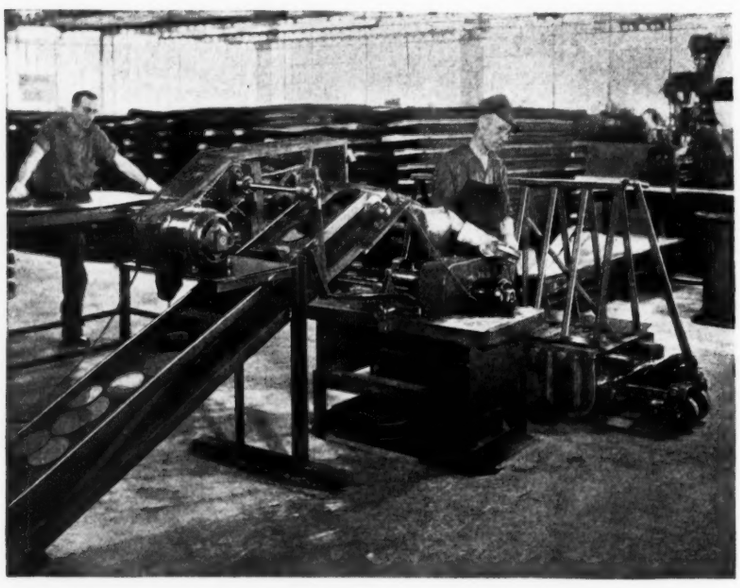
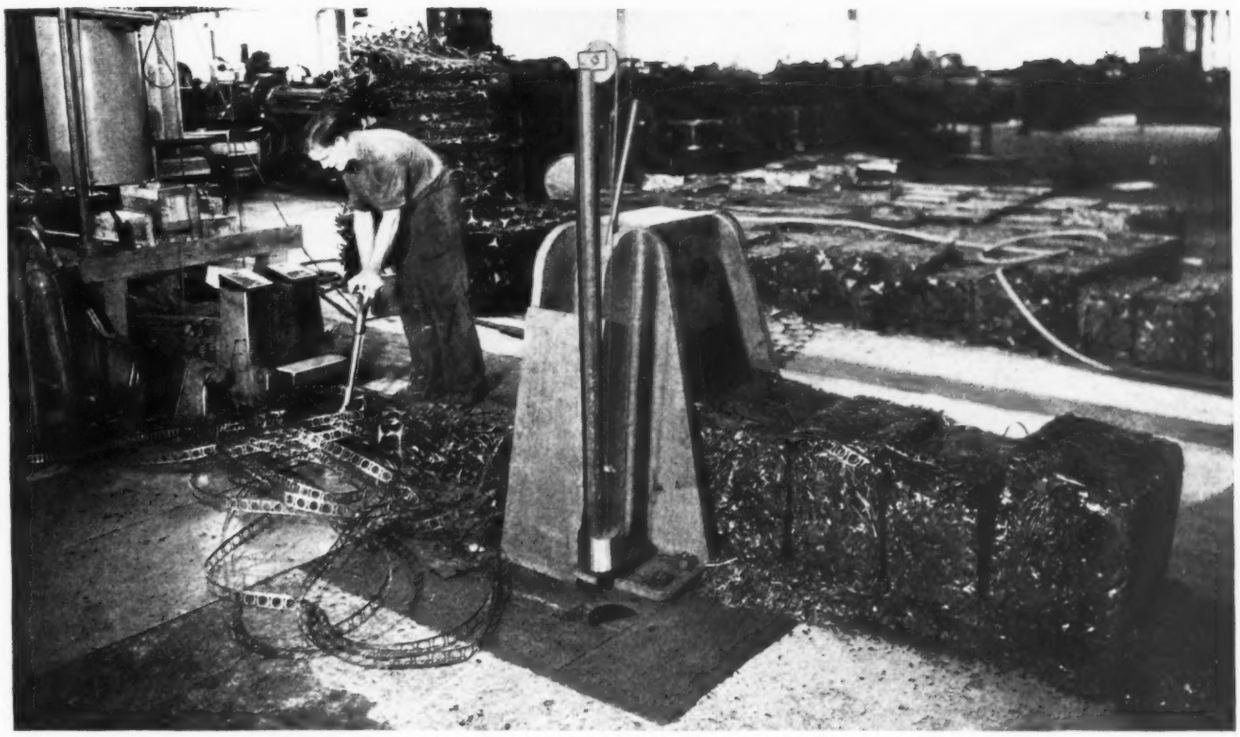


Fig. 1. (Above) Circular Blanks Fall Six at a Time from the Die in This Press and Drop on a Conveyor System which Carries Them to an Adjacent Sorting and Stacking Machine

Fig. 2. (Left) General View of the Inclined Conveyor that Delivers the Blanks to the Sorting and Stacking Machine



where they are caught by the inclined conveyor belt that is seen directly to the right of the press. This belt discharges the blanks into the short chute which leads to the elevating type of conveyor seen at the extreme right of the illustration. This conveyor carries the blanks, as shown in Fig. 2, to a machine that sorts out the imperfect ones and stacks the good ones together, so that they can be easily placed on truck skids.

Fig. 4 shows a close-up view of this sorting and stacking machine. It will be seen that the blanks fall automatically in a vertical position between short conveyor screws at the front and back of the machine. The thin thread on these screws is of different lead at the left-hand end than at the right-hand end. Also, the rear screw is of larger diameter than the front screw, and they run in opposite directions so as to revolve the disks and at the same time gradually feed them to the right. Any blanks that are not the full diameter because of being cut too near the end of a sheet fall between the two screws into the bed of the machine.

All blanks of full diameter drop off the right-hand end of the screws to two bars on which they are held, still upright, against a spring-backed stop. As the blanks accumulate, the attendant removes them to truck skids. Twenty thousand blanks are stacked on a skid, by means of which they are conveniently transferred to the presses that produce the stator and rotor laminations.

Fig. 3. (Above) The Scrap Produced by All the Presses in the Department is Immediately Compressed into Bales Weighing 350 to 400 Pounds, for Convenient Shipment to Steel Mills

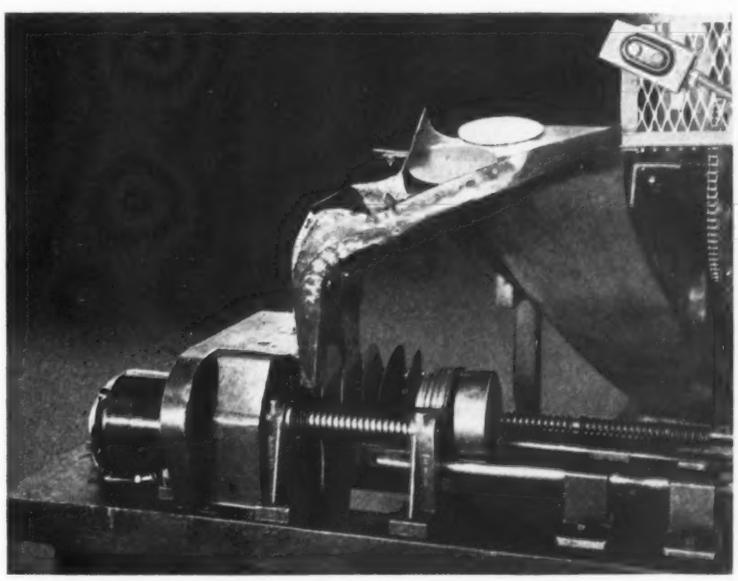


Fig. 4. (Right) The Machine that Sorts out Imperfect Blanks and Stacks the Good Ones for Convenient Removal to Truck Skids

Fig. 5. The Three Machines in Each of the Conveyor-connected Batteries Seen in the Heading Illustration are Equipped with These Dies for the Production of the Stator and Rotor Laminations

The press shown in Fig. 1 is equipped with a shear operated from the ram, which cuts the scrap into lengths of about 1 foot. The shear is not seen in the illustration, as it was removed at the time the photograph was taken. The scrap from all the presses in the department and from the sorting and stacking machine is delivered to the adjacent baling machine illustrated in Fig. 3. Hydraulic pressure of 2500 pounds per square inch is developed by this equipment for compressing the scrap into bales weighing from 350 to 400 pounds each.

In this operation, the loose scrap is loaded into a hopper in the floor, which is 24 inches deep by 18 inches wide by 6 1/2 feet long. When the hopper has been filled, a slide is fed forward to cover it. Then a hydraulic ram is advanced to compress the scrap against the end of the hopper, after which a hydraulic ram rises vertically at this end to finish the baling operation. This ram is also employed to raise the bale to the floor level after the cover has been partly withdrawn. The cover is then used to push the bale along the floor for convenient removal by means of a hand truck.

Beginning with the presses that produce the stator and rotor laminations from the blanks, the plant is laid out with paralleling lines of machines and assembly benches for the uninterrupted manufacture of motors by any one of the lines without dependence upon the other lines. In other words, the line that produces washing machine motors can operate continuously, whether or not the line for manufacturing motors for refrigerators, stokers, etc., is in operation.

A general view of a battery of presses engaged in producing stator and rotor laminations in one of these motor manufacturing lines is shown in the heading illustration. These presses are arranged in groups of three, which are equipped with dies of the types seen in Fig. 5. The first machine in each group is provided with a die of the type at the left, which punches the rotor lamination from the center of the blank. A close-up view of such a

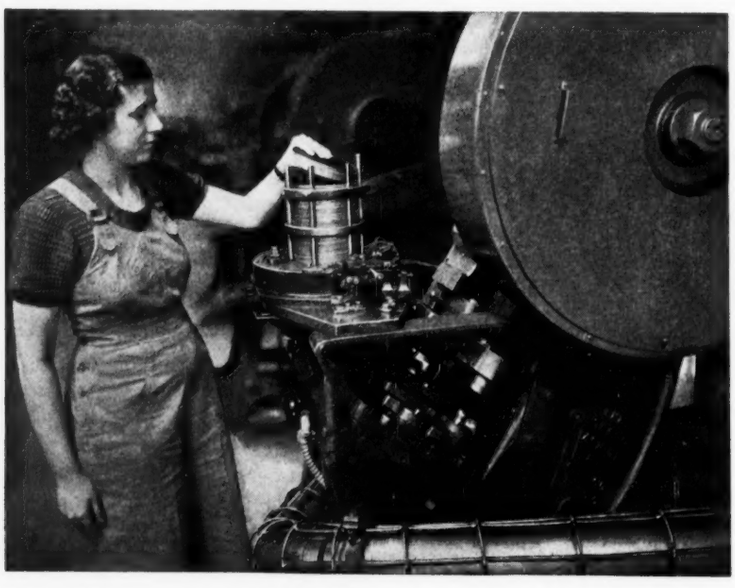


Fig. 6. Rotor Laminations Produced by This Press Pass Directly through the Die to a Rack which Leads to the Rotor Slotting Press, while the Stator Laminations Fall on a Conveyor Belt

Fig. 7. Rotor Laminations Fall from This Slotting Press to the Conveyor Seen in the Lower Left-hand Corner. The Conveyor in Foreground Carries Stator Laminations to Stator Slotting Press

press is illustrated in Fig. 6. The girl operator loads the blanks into a self-feeding hopper from the truck skids that are loaded at the sorting and stacking machine already described.

The blanks are permitted to slide, one at a time, into the die from the bottom of the magazine through the operation of a mechanism actuated by the crankshaft of the press. Each time that the press ram ascends, a blank slides into the die; when the ram descends, a rotor lamination is punched from the center of the blank and discharged through the die to a long rack extending from the center of the die and around the machine to a press which blanks slots around the edge of the rotor laminations and four holes in and about the center.

The stator lamination is pushed off the punch by the stripper plate. It falls on a conveyor belt that passes by the rotor slotting press, as seen in Fig. 7, to the press illustrated in Fig. 8, where winding slots are blanked around the hole by means of a die such as seen at the right in Fig. 5. This completes the stator lamination. The girl sitting by this machine merely watches the laminations to detect blanks that are bent or otherwise defective.

As the stator laminations approach this press, they are halted momentarily by a bar that is reciprocated across the conveyor belt through a motion derived from the crankshaft. This bar permits them to slide into the die one at a time with the upward stroke of the press ram. The slotted stator lamination is pulled off the punch by the stripper plate, and slides down a chute to the wide conveyor belt seen in Fig. 9, the scrap falling from the die into a receptacle. This conveyor belt carries the stator laminations from each group of presses to a stacking machine which will be described later.

Seventy-six blanks are fed a minute into the rotor producing press shown in Fig. 6. The stator slotting press, to which the stator laminations are automatically fed by the conveyor, is operated at eighty-two strokes a minute, so as to make certain that it can keep up with the production of the first

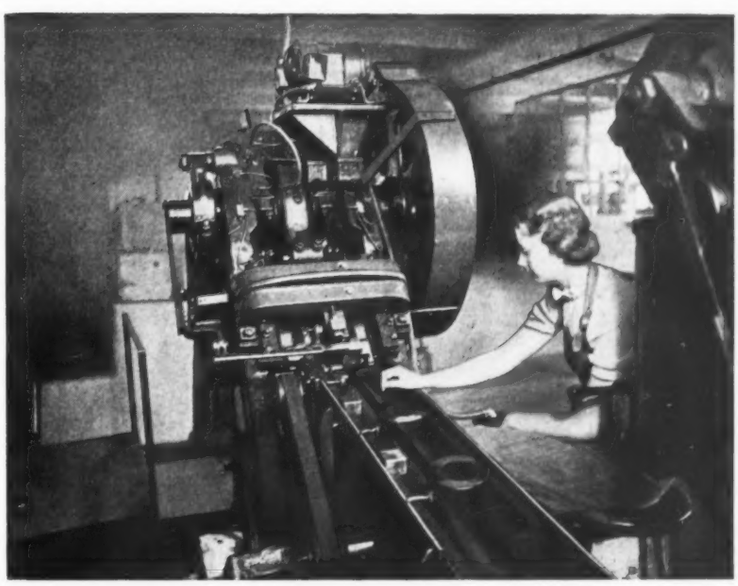


Fig. 8. The Stator Laminations Arriving by Conveyor Belt at the Slotting Press from the First Press of the Battery Slide into the Die in Synchronism with the Ram Movements

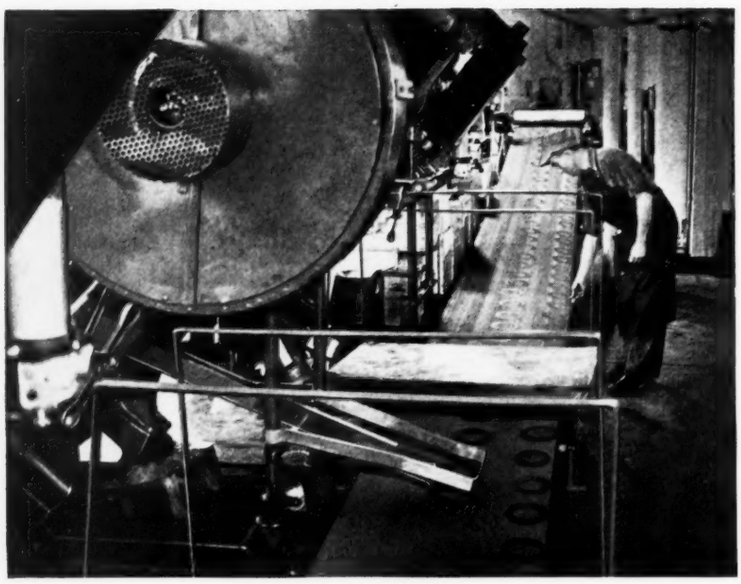


Fig. 9. The Stator Laminations from the Groups of Presses Shown in the Heading Illustration are Discharged on a Conveyor Belt which Carries Them to a Sorting and Aligning Machine

press and catch up with that press in case of a slight delay.

The rotor slotting press, Fig. 7, is equipped with a die such as seen at the middle in Fig. 5, and with a magazine or hopper similar to that used on the first press of each group. Again, the laminations are released one at a time in synchronism with the ram movements. The finished rotor lamination slides from the die, when stripped off the punch, and falls upright between vertical guide bars on the belt conveyor seen in the lower left-hand corner of the illustration. This conveyor leads to the machine seen in the foreground of Fig. 10. The rotor laminations produced by three presses are received by this conveyor.

Sorting and Aligning Rotor Laminations

The rotor laminations are discharged by this conveyor, still upright, into chutes that lead them between short conveyor screws similar to those of the sorting machine previously described. On this machine, however, there are two sets of sorting screws. The set at the back receives laminations from two lanes of the conveyor and stacks them on racks extending on both sides of the machine. The second set of conveyor screws sorts the laminations from the third conveyor lane and stacks them on the front rack which extends toward the right. As the laminations are revolved by the conveyor screws, any that are not full diameter fall through the screws, while the perfect laminations are fed out along the racks.

The sorted rotor laminations are taken from this machine and placed on the revolving spindles of the machine seen at the right of the illustration. The spindles of this machine reverse intermittently, causing the laminations to adjust themselves around the spindles until a keyway in each lamination lines up with a key on the spindle. When sev-

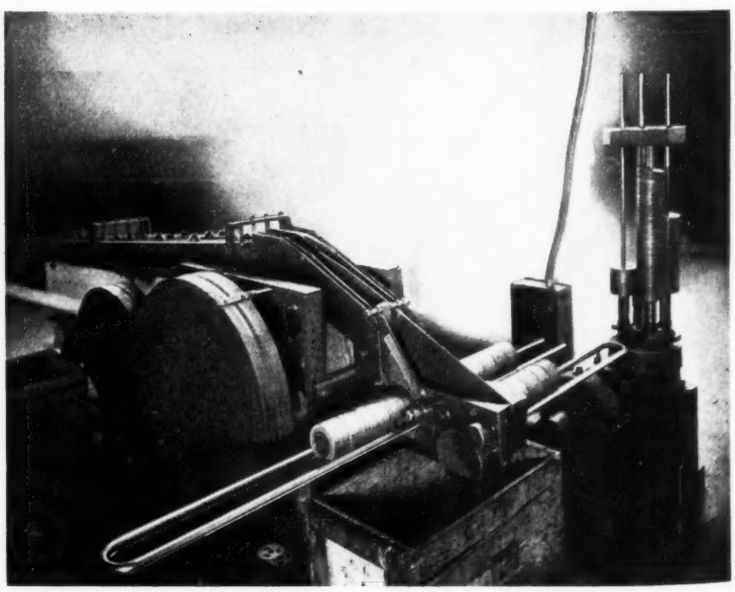


Fig. 10. Imperfect Rotor Laminations are Sorted out by the Machine in the Foreground, and the Good Laminations are Lined up in Relation to a Keyway by Means of the Machine in the Rear

Fig. 11. The Stator Laminations are Stacked on Revolving Spindles and Lined up in Relation to a Slot in the Periphery by Means of Keys on the Adjacent Vertical Posts

eral laminations have been thus lined up, they are removed in batches and slipped over two vertical posts on fixtures, the posts being located the necessary distance apart to suit two of the holes in the rotor laminations. In this way, the laminations can be kept in proper alignment for convenient assembly in required numbers.

How the Stator Laminations are Sorted and Aligned

The wide conveyor belt seen in Fig. 9 carries the stator laminations from three presses to the sorting and aligning machine illustrated in Fig. 11. Here the laminations pass between two rolls that tip them upward slightly as they are about to be discharged from the conveyor so as to prevent their sliding between the conveyor belt and the chutes leading to the sorting machine. From these chutes, the laminations fall over the nose of revolving arbors having the appearance of projectiles.

As the laminations revolve with these arbors, they shift around until a slot in the periphery of the lamination is lined up with a key that extends the length of a vertical post at one side of the arbor. Then the lamination is free to slide downward on the arbor and no longer revolves. The operator readily detects any imperfect laminations and removes them as she transfers stacks of laminations to similar arbors at the front of the machine.

When the laminations are lined up on the second set of arbors, the girl slips long nails into two of the slots to hold them in alignment while she weighs them out in quantities required for each stator assembly. Each assembly is then riveted together by a hydraulic arbor press, for which operation keys are slipped into two of the rows of slots, so as to hold the laminations in proper alignment.

A Survey of Machine Tool Purchases

ACCORDING to a survey recently made by the Warner & Swasey Co., Cleveland, Ohio, more machine tools were purchased by industry in the last two years for expansion than for replacement. Smaller companies forged ahead more rapidly than larger ones in purchases of machine tools during the same period. The total buying of new machine tools for both expansion and replacement in the two-year period has been at the average rate of only 4.8 per cent a year of the total machine tools in use.

These conclusions are based on replies received from 251 representative concerns in all major industrial divisions, having an estimated total of about 9 per cent of all the machine tools used in this country.

Of the new machine tools purchased in the last two years, about 40 per cent were for replacement of old machines. For every 100 new machines purchased, approximately 64 old machines were scrapped. Where the machines were bought for replacement purposes, however, approximately 3 old machines were scrapped for every 2 new machines purchased. The survey also brought out that of the machine tools now used by the companies who answered the questionnaire, 67 per cent are over ten years old.

Typical of the comments as to why desirable replacement programs had not been carried through is that of one manufacturer who remarked tersely that he would make large replacement purchases this year "if it were not for the undistributed profits tax, the capital gains tax, and the inability to finance."

D. O. James Mfg. Co. Celebrates Fiftieth Anniversary

The D. O. James Mfg. Co., Chicago, Ill., manufacturer of gears and speed reducers, celebrates its fiftieth anniversary this year. It was in 1888 that D. O. James incorporated the D. O. James Machine Co. for the manufacture of gears, tools, dies, and special machinery. At first the shop employed about ten men.

In 1893, a new company was incorporated under the name James-Grant & Foote. This company employed about twenty men manufacturing gears, tools, and special machinery. In 1895, D. O. James sold out his interest and started a partnership, James & Foote, manufacturing gears, tools, dies, special machinery, and milling machines, as well as bicycle parts and other machine parts. At times they employed over thirty men. In 1905 this plant was destroyed by fire. The organization sustained a serious loss and the partnership of James & Foote was dissolved.

D. O. James then incorporated the D. O. James Mfg. Co., specializing in the manufacture of cut gears and speed reducers. The first commercial planetary speed reducer was designed and placed on the market. Worm-gear reducers were also made at this time. Since that time the company has made rapid strides, and at present, is a leading manufacturer of gears and speed reducers of practically all types.

* * *

Opportunities for Teaching in Vocational Schools

Competent apprentice and vocational school instructors in the machinery field are of the greatest importance to industry. Vocational schools throughout the United States, under the guidance of the various State Education Departments, are cooperating with industry and business in aiding young men to prepare for, enter, and to make progress in the machine industries as competent workers.

To make vocational school teaching effective, a competent teaching personnel is of first importance. Competent mechanics having the qualities of leadership and interest in the training of young men are necessary as teachers of trade and apprentice classes. The various State Education Departments are providing for the necessary teacher training of men qualified for teaching work by competence in their trade. In New York State, the Industrial Teacher Training Department is located at 80 Center St., New York City. Most of the other states maintain similar training services, information relating to which may be obtained by addressing the State Education Department of the respective states.

It is obvious that the mechanics of the future must be trained, in part, by the mechanics of today; hence men skilled in their trade must be encouraged to become teachers in vocational schools. Industry must furnish a limited number of mechanics competent to become trade school teachers, just as men are developed for supervisory, sales, and engineering positions.

The opportunities for advancement in this field of teaching are attractive to competent men. The salaries of trade school teachers, like wages in industry, vary with the sections of the country. For example, the salary of the vocational trade teacher in Pittsburgh starts at $1800 a year and advances to $3200 a year. In Chicago, the starting salary is $1800, advancing in ten years to $3800. In New York, the trade teacher usually starts at $9 a day, while serving on a permanent substitute license. When he obtains a regular appointment, he starts at $2140 annually, with increases of $150 a year until an annual salary of $4500 is reached.

* * *

Keeping Employes Informed on Company Operations

Manning, Maxwell & Moore, Inc., operating plants in Bridgeport, Conn., Boston, Mass., Muskegon, Mich., and Jersey City, N. J., at one of its plants recently gathered over a thousand employes in a local auditorium, where the president of the company, Robert R. Wason, presented a detailed report covering the company's operations during the past year.

Using some sixty animated lantern slides, Mr. Wason went into every phase of the operations of the company, which does an annual volume of business of approximately $10,000,000 in the production and sale of cranes and hoists, gages, valves, locomotive and railway equipment, precision instruments, and mill supplies. Mr. Wason explained in detail what happened to every dollar received by the company, showing how much was spent for materials, wages, and salaries, and for interest on investment, as well as how much remained in profit and how much of the profit had been reinvested in plant and equipment.

An interesting fact brought out was that approximately 84 per cent of the company's income was due to sales of new products developed by the company since 1932. Another interesting point is that 45 per cent of the employes at the company's Bridgeport plant are over forty years old.

An innovation at the meeting was the distribution of slips and pencils and an invitation to write down questions. At the close of the talk, Mr. Wason answered each of the questions presented. In conclusion, he said: "What business needs today is a chance to settle down and go to work."

* * *

Giving birth to an idea is one thing; raising it to maturity is another.—*United Effort*

Forging Operations on Automobile Parts

Second of Two Articles Dealing with Some of the Advanced Practices in the Dodge Forge Plant

ADVANCES in forging practice made by the automotive industry were pointed out in an article published in April MACHINERY, page 494, which illustrated several outstanding examples of present-day practice as carried out in the Dodge Forge Plant, Detroit, Mich. That article described the production of ring-gear blanks for passenger automobiles, crankshaft forgings, and connecting-rod cap forgings. Additional operations in the same shop will be described in the following, including the forging of ring-gear blanks under steam and drop hammers for motor trucks.

The first operation on the truck ring gears is illustrated in Fig. 1. Four-inch square blocks of nickel-molybdenum steel, heated to 2100 degrees F., are first beveled on the four corners between the flat surfaces of the dies, and then hammered into disks about 13 inches in diameter by 2 1/2 inches thick, in the impressions of the dies. About fourteen blows are struck in this operation, an Erie 5000-pound steam hammer being employed.

The forging is then handed to the operator of another hammer of similar capacity, shown in Fig. 2, for hammering the blank to a diameter of about 14 inches and a thickness of 2 1/4 inches. Next a hole 8 inches in diameter is punched in the center by dies mounted in a power press, after which the forging is returned to the machine shown in Fig. 2 for a restriking operation. About 240 ring gears are produced per machine in an eight-hour day.

Connecting-rods for Dodge automobiles are forged two at a time from high-manganese bar stock which is rolled at the steel mill to a varying cross-section, as shown in the upper left-hand view, Fig. 3. If a bar of uniform cross-section were used, a much greater amount of stock would be required. The maximum width of the bar is about 1 5/8 inches, and the thickness 3/4 inch. This stock comes in lengths of about 18 feet and is cut into bars 15 1/2 inches long for the forging operation.

In this operation, which is performed by the 3000-pound steam drop-hammer illustrated in Fig. 4, the stock is first blocked in impressions provided on both sides of the dies, and is then finished in two impressions at the center of the dies. Each of the two blocking steps requires about four blows of the hammer. Three blows are made with the stock in the first shaping impressions, and about two in the second shaping impressions, making about thirteen blows to produce each forging of two rods. After being trimmed, each connecting-rod forging is approximately 8 3/4 inches long.

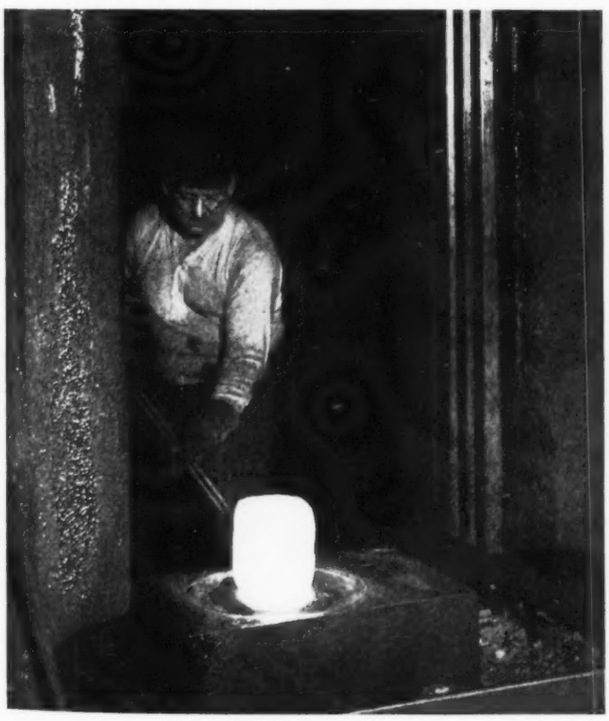


Fig. 1. Hammering a Truck Ring Gear from a Square Bar of Hot Nickel-molybdenum Steel

Fig. 2. Last Step in Forging Truck Ring Gears; Restriking after the Hole has been Punched

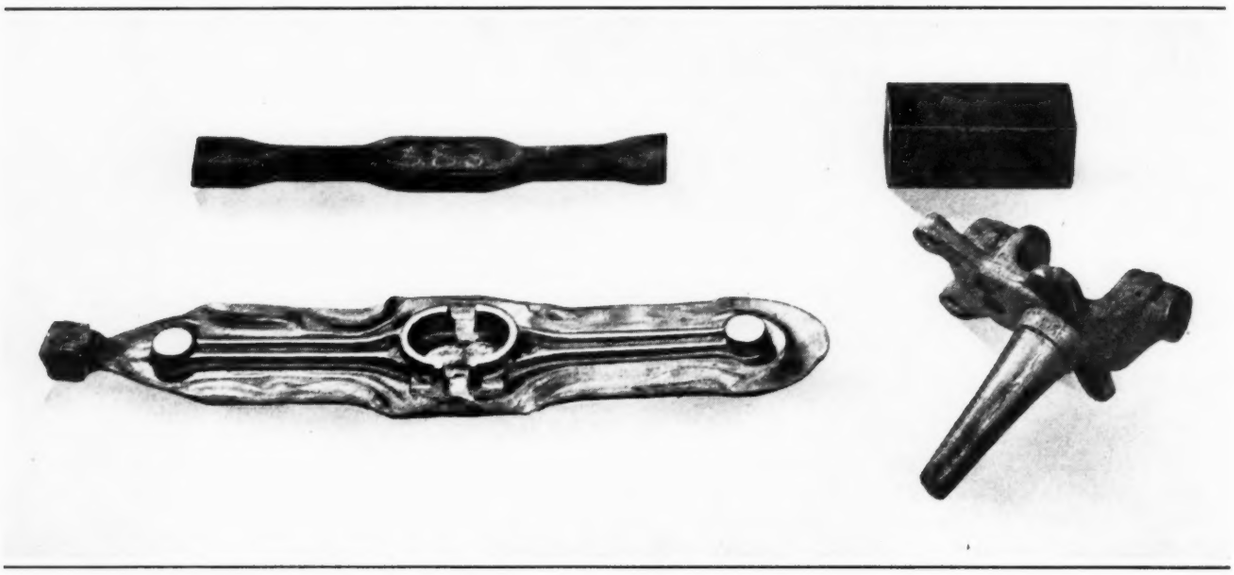


Fig. 3. Connecting-rod and Steering-knuckle Forgings, and the Rough Stock from which They are Formed

The production per machine is about 1650 connecting-rods in an eight-hour day.

A case of extreme shaping of metal in a forging operation is presented by the steering knuckle shown at the right in Fig. 3, which is produced from a piece of stock such as shown directly above it. This is SAE 3135 nickel-chromium steel, 2 3/4 inches square, cut to 6-inch lengths. The dies used in forging this part are made for hammering with the piece held both vertically and horizontally. This operation is performed in an Erie 5000-pound steam drop-hammer.

Cluster gear forgings of the type seen on top of the left-hand die in Fig. 5 are produced in a hot heading operation from chromium-vanadium bar stock, 1 13/16 inches in diameter by 16 inches in length. This operation is performed in a 5-inch forging machine built by the National Machinery Co., which is equipped with the dies shown. In the first step of the operation, the stock is inserted in the top impression of the dies. Then when the dies are closed as the machine is operated, the advancing punch locates the stock for length by pushing it against the stop seen on the die illustrated at the right. As the punch completes its stroke, the stock is expanded slightly at the forward end to form a tapered bar.

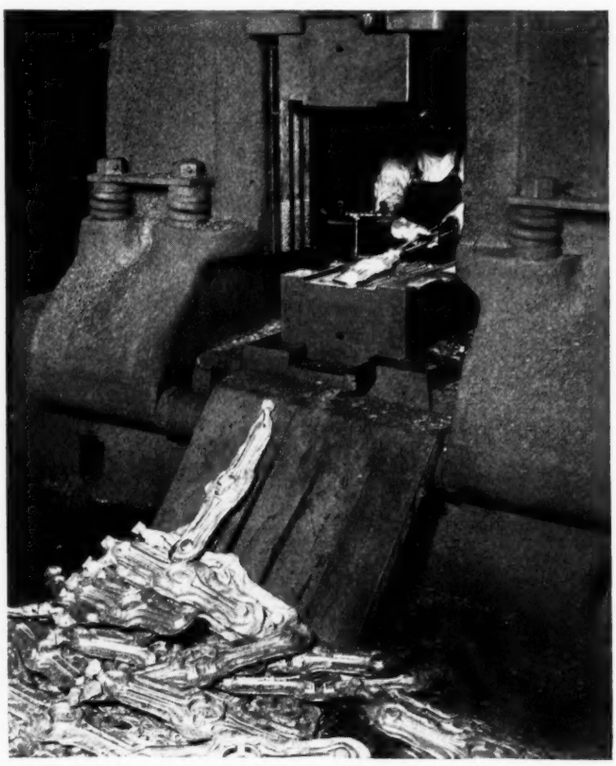


Fig. 4. Connecting-rods for Dodge Automobiles are Forged Two at a Time from Stock Rolled to the Shape Seen in the Upper Left-hand View of Fig. 3

For the next step in the operation, the stock is placed in the second impression from the top of the dies, to forge the two gear diameters on one end. The larger of these diameters is formed by the stock being expanded to fill the die impression, while the smaller diameter is produced by a hollow punch which enters this impression. The end of the forging that extends toward the left from these gear surfaces, as the part is seen in Fig. 5, is also expanded to a larger diameter by the hollow punch.

For the third step in the operation, the forging is turned end for end and placed in the next die impression. The opposite end of the forging, which is to be forged to its largest diameter, is then partially shaped by a hollow punch, this gear surface being completed in the fourth impression of the dies, where a solid punch is employed. The production is about 680 gear blanks per eight-hour day.

Intake and exhaust valve tappets are hot-headed in 1 1/2-inch

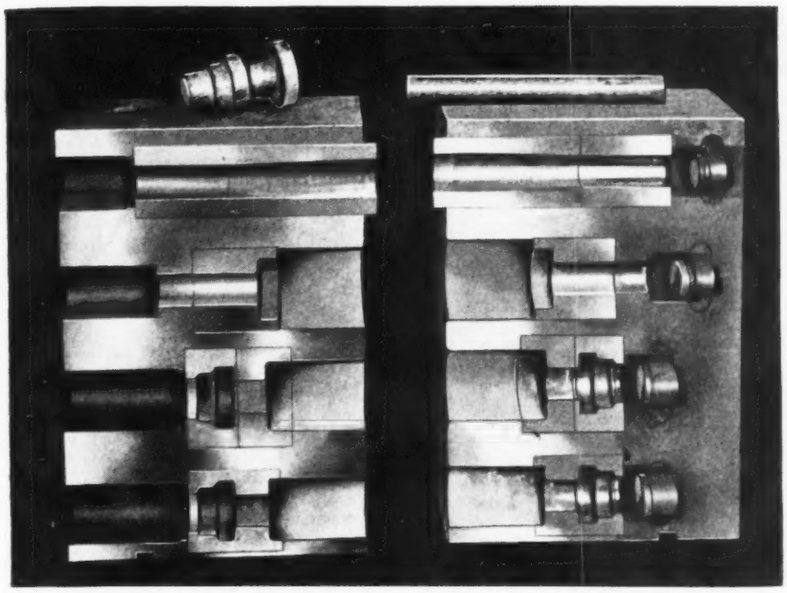


Fig. 5. Dies Used for Hot-heading Cluster Gears of the Type Seen on Top of the Left-hand Die from Round Bars Such as Seen on the Right-hand Die

forging machines equipped with dies and punches of the types illustrated in Fig. 6. Four strokes of a machine are required to produce a valve. The bar stock is 0.365 inch in diameter, within plus 0.012 inch minus 0.000 inch, by 9 inches long, while the valve forging is 4 3/4 inches long, with a head 1 5/8 inches in diameter. Intake valves are forged from nickel-chromium steel, and exhaust valves from Silicrome steel.

The operation consists of gradually forming a conical head on one end of the stock by means of the hollow punches seen on the holder at the left in Fig. 6. These punches are applied by successively entering the stock into the three grooves of the upper die-blocks shown at the right. The integral disk-like head is then produced in the impressions of the bottom die-blocks by means of a solid punch at the bottom of the punch-holder. In each of these steps, the punch advances within 1/16 inch of the die faces.

An interesting feature of the dies used in this operation is the provision for obtaining long life. Each of the dies is made in two pieces, because the grooves in which the stock is held for the first three steps have a much longer life than the impressions in which the head is formed. Grooves are machined in two faces of both upper die-blocks, so that these blocks can be turned end for end in the forging machine when one set of grooves has been worn beyond the desired limits.

The bottom blocks, in which the valve head is formed, are also machined on two sides; on each side there are grooves running at right angles to each other and four impressions for forming the valve head. This means that the bottom die-blocks can be used in eight positions before any refinishing of the impressions is required.

After the valves have been headed in these dies, they go to a coining press, where the head is compressed to the required thickness and shape, ready for grinding. Identification symbols are stamped on the head at the same time.

* * *

Proving the fallacy of the current impression that the effective life of an industrial worker lags after he reaches forty, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., states that out of the 51,151 people employed by the company at the end of last year, 6355 have been with the company for twenty or more years; in other words, they are about forty or more years old. Eight of these men have been employed by the company for fifty years or more; 121 from forty-five to fifty years; 148 from forty to forty-five years; 844 from thirty-five to forty years; 1159 from thirty to thirty-five years; 1614 from twenty-five to thirty years; and 2432 between twenty and twenty-five years. The average age of all the employes of the company at the end of 1937 was thirty-six years.

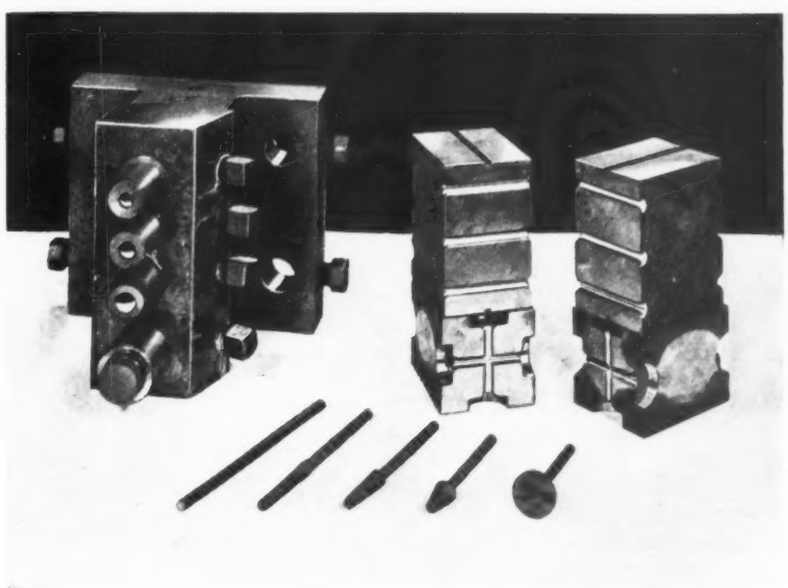
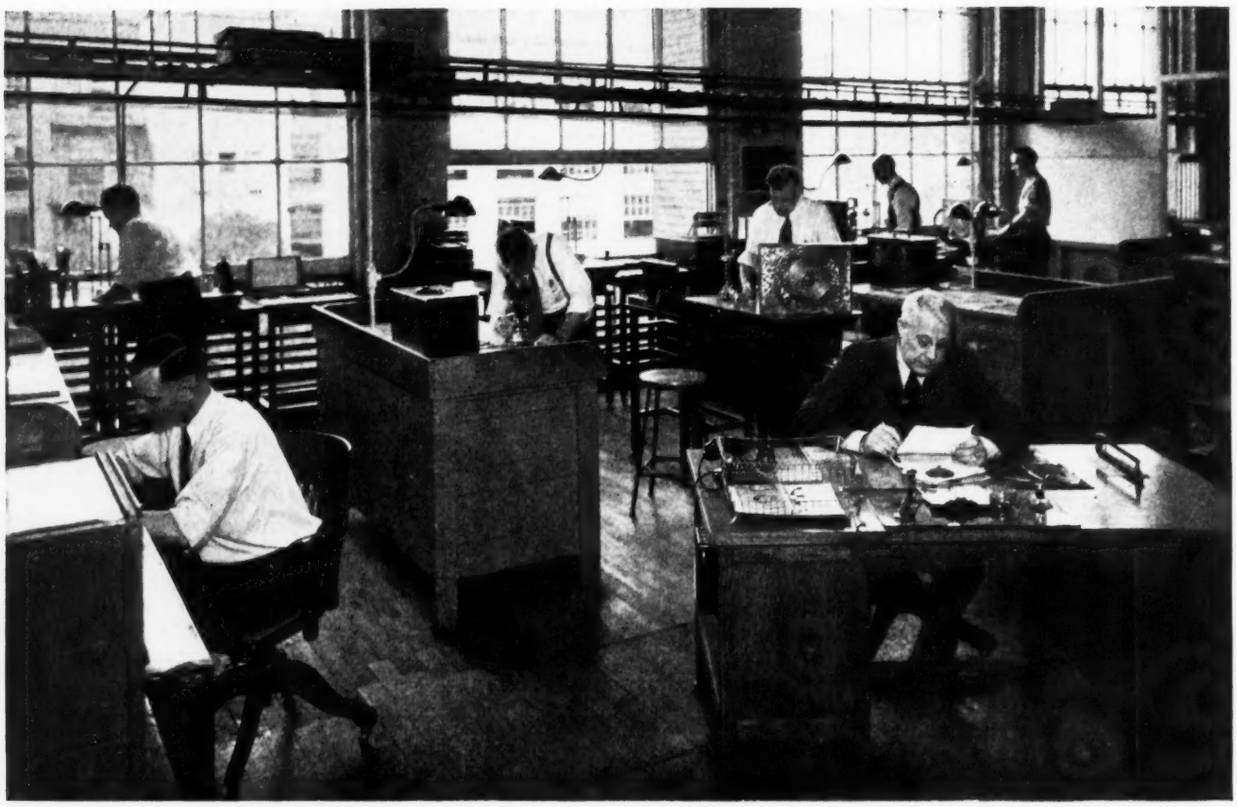


Fig. 6. Punches and Dies Employed for Forging Valve Tappets in the Four Steps Indicated by the Pieces Seen in Front of the Die Equipment

Inspection-Checking Department



A System of Checking the Correctness of All New or Changed Parts before They are Assigned to Routine Inspection, and of Investigating Assembly and Service Complaints

A HIGHLY developed inspection system is used to control the accuracy of tens of thousands of different parts required in manufacturing the products of the National Cash Register Co., Dayton, Ohio. In connection with this system, an inspection-checking department has been established that minimizes the production of defective work in any operation throughout the plant, by checking a sample of the first lot of each new or changed part before releasing the parts for routine inspection. The gages by which the part will be checked during its various stages of manufacture are also inspected by this department or section.

Another activity of this section is to investigate all complaints arising in the assembly of register units with regard to parts that fail to function satisfactorily when assembled. Complaints arising from registers in service are also investigated by the inspection-checking section.

The inspection-checking section is completely detached from the remainder of the inspection department and reports directly to the chief inspector. The men in this section are specially trained mechanics who have been selected for their extensive knowledge of model-making, toolmaking, production operations, assembly methods, and inspection practices. They are not primarily inspectors, but men who know exactly how the work-pieces should be made and how they should function when assembled.

The samples of new or changed parts arriving in the inspection section are carefully examined to determine if the dimensions are within the limits specified on the drawing made by the engineering division. Gages for the part are examined to see that all vital points will be checked. If the gages and part are satisfactory, the job is scheduled to be inspected in the regular way, and an inspection instruction card is suitably marked.

When gages are not available for a new job or when they do not check the part satisfactorily, special checking equipment is employed in the inspection-checking section. Then, if the work meets engineering specifications, the stock order card and

Controls Quality of Work

By
C. E. STINES, Chief Inspector
The National Cash Register Co.

the inspection instruction card are stamped with the date of the checking and the date when the drawing was issued, and the work is assigned for routine inspection.

A permanent record of all parts checked by the inspection-checking section is maintained in a master file. Each job is filed under the name of the part and given a sequence number for identification purposes. Whenever calculations have been made by an inspector, the sheets of paper used for the calculations are given the same sequence number and then filed in a manila envelope for convenient reference.

Work that Fails to Pass Inspection

Should a sample of new work fail to meet engineering specifications, an investigation is made to determine whether the inaccuracy is due to the tools that produce the part or to faulty workmanship. The responsibility having been determined, the record for the master file and the inspection instruction card are both stamped "rejected," and the defective work is returned to the production department in the regular manner.

If the error is due to the tools, a rejection slip printed on red cardboard is attached to the regular rejection ticket. This rejection slip is made in triplicate. It gives the part name, the date of inspection, the inspector's signature, and the errors found in the work. One copy of this slip is returned with the stock to the production department, the second is sent to the tool inspection department, and the third is retained by the inspection-checking section. The third copy is placed in a tickler file until a sample of corrected work is sent to the inspection-checking section. The second sample is then checked, and if found to pass inspection, the work is released for regular inspection.

This method of preventing work from passing through the shop until approved by the inspection-checking section not only guards against a second order being produced with incorrect tools, but also prevents any parts made on the first order that may still be in process in the shop from being passed by the inspection department until the necessary corrections have been made.

Investigating Shop and Field Complaints

Complaints referred to the inspection-checking section from production or assembly departments generally relate to difficulties caused by variations in the thickness of stock, plating defects, overlapping limits, distortion, or other troubles that prevent the part from meeting the specified quality

Fig. 1. Complicated Mechanisms are Carefully Studied to Determine what Parts are Causing Operating Difficulties

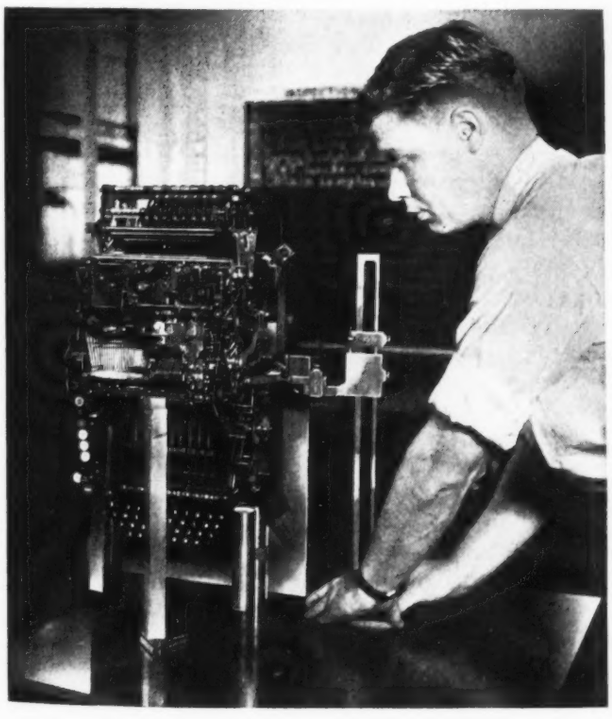


Fig. 2. Indexing Heads of Special Design Facilitate Many of the Activities in the Inspection-checking Section

standards. These complaints are referred to the inspection-checking section by the departments affected, and are investigated with the aid of the engineering, planning, and production departments. Decisions are finally made as to the best method of correcting the difficulties.

If an engineering change is found necessary, a recommendation is made to the engineering department through the chief inspector. Recommended changes in tools or production methods are handled through the planning department.

Complaints arising in assembly departments that necessitate the checking of register movements are all handled by the inspection-checking section. It is often necessary to make special lay-out drawings or to construct plate models in order to check all movements of a complicated mechanism. Such an investigation is shown being made in Fig. 1.

The advantage gained by investigating functional difficulties in this manner is that the part causing the trouble can be detected and changed; thus time is not wasted in replacing a part that may seem to be causing the trouble but that is not really responsible for it. The engineering division will not authorize any changes in established mechanisms until after a difficulty has been thoroughly analyzed by the inspection-checking section.

Field complaints that require this type of investigation are referred to the inspection section by the chief inspector. The findings are handled in a way that will insure prompt correction.

The equipment of the inspection-checking section consists of various instruments, such as gage-blocks, micrometers, vernier calipers, height gages, indicators, a microscope, and so on. Special checking heads such as seen in Fig. 2, which have been designed and made at the plant, are used for a large variety of work. They are constructed without gears, screw threads, or worms, thus eliminating any inaccuracies through lost motion.

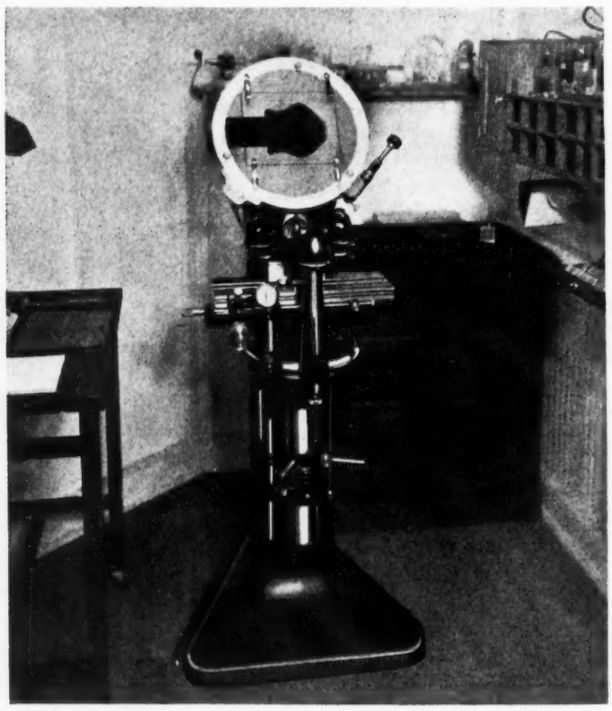


Fig. 3. Irregular Shapes and Contours and the Movements of Mating Parts are Studied by Means of the Jones & Lamson Comparator

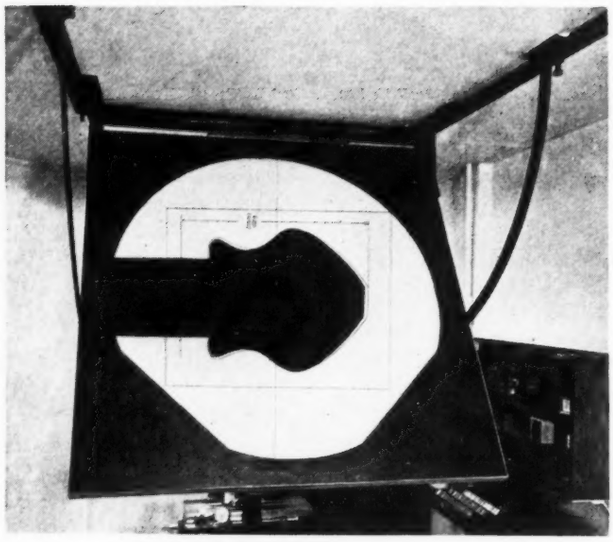


Fig. 4. The Use of an Auxiliary Screen in Combination with the Optical Comparator Shown in Fig. 3 Enables Magnifications of 128 to 1 to be Made without Distortion

The equipment of the section also includes the Jones & Lamson optical comparator shown in Fig. 3, which is set up in a dark room. Considerable auxiliary equipment has been designed to enable this equipment to be used in the projection and measurement of parts that are peculiar to the mechanisms made by the National Cash Register Co. The comparator, for example, is used not only for checking irregular shapes and contours, but also for observing movements of mating parts.

For checking irregular shapes and contours of gear teeth, cams, etc., an accurate lay-out of the part is made on a 35 to 1 scale. This lay-out is then photographed on a glass plate that can be mounted over the ground glass screen of the comparator for projecting the shadow of the work on the glass plate in the regular manner. The glass-plate templet constitutes a permanent record which is subject only to changes due to variations in temperature. One of these glass-plate templets with its contour lines can be seen in Fig. 3.

Experience has shown that an amplification of 35 to 1 is best suited for investigating the majority of problems arising in this plant. However, there are occasions when a greater magnification is desirable, and in order that this may be obtained without the distortion which often occurs when parts are greatly magnified by means of optics, use is made of an auxiliary screen which gives a magnification of 128 to 1 in combination with the regular 35 to 1 optic. As may be seen in Fig. 4, this auxiliary screen is suspended from the ceiling.

Machine Tool Builders Discuss Many Current Problems

THE National Machine Tool Builders' Association held its thirty-sixth spring convention at the Edgewater Beach Hotel, Chicago, Ill., May 2 and 3. The attendance was greater than at any previous meeting of the Association. A great many different problems of the industry were discussed, covering questions of management, sales, and engineering.

The president of the Association, Howard W. Dunbar, vice-president of the Norton Co., Worcester, Mass., in his address, "A Long Look Ahead," covered many different phases of the business situation. He pointed out that never before has there been a business recession when so many of the fundamentals conducive to good business were in evidence. There is an ample supply of money looking for the opportunity to be employed in constructive enterprises; credit is easy; and there is a tremendous dormant demand not only for machine tools, but for all the products of American industry. On the other hand, never before has industry been faced with such radical changes in policies that threaten to shackle it by regulation, as well as by an increasing burden of taxation.

© Bachrach

Howard W. Dunbar, President of the National Machine Tool Builders' Association

"In the past," said Mr. Dunbar, "our problems were written around manufacturing and selling, because they seemed the two cardinal principles upon which successful business was built. In late years, we have been confronted with a multitude of new problems, largely the result of matters directly related to labor and legislative activities.

"The only way in which we can maintain our present high standard of living is by steadily continuing to use improved machine tools; for it is an axiom that the only way by which our standards of living can rise is by an increase in production. ... There must be a careful study of all the factors which enter into the cost of manufactured products. A return on invested capital can be obtained only by improved manufacturing facilities and the lowering of production costs. There must be higher efficiency in order to pay the higher wages of today."

Referring to current agitation and governmental policies, Mr. Dunbar said: "One might be led to believe by some of our present-day theorists that profits in business are a curse.... But straight thinking will some day lead to the conclusion that those who make substantial profits should be commended—not those who make small profits or no profits at all. For, after all, wage payments are the largest when industrial profits approach a normal satisfactory figure in industry."

In conclusion, Mr. Dunbar emphasized the fact that business is founded largely on confidence and that fear is the greatest influencing factor in the present recession. It kills initiative and causes capital to become cautious. Not until confidence is restored, can business go forward.

Among other important papers presented before the meeting were the following: "How Can We Extend Effective Publicity Efforts?" by Clifford S. Stilwell, vice-president, Warner & Swasey Co.; "The Committee on Legislation Reviews National Laws," by Norman D. MacLeod, president, Abrasive Machine Tool Co.; "Reciprocal Tariffs and Machine Tools," by L. W. Scott Alter, president, American Tool Works Co.; "Why Should Yesterday's Selling Ideas Lose Tomorrow's Orders?" by J. Y. Scott, executive vice-president, Van Norman Machine Tool Co.; "Standard Practices in Builder-Dealer Relations," by Henry C. Pierle, secretary, R. K. LeBlond Machine Tool Co.; "Some Recently Adopted Technical Standards Applicable to Machine Tool Design," by J. E. Lovely, vice-president and chief engineer, Jones & Lamson Machine Co.; "Efforts Toward Achieving a National Standard for Machine Tool Motor Terminals," by B. N. Foster, chief engineer, Kingsbury Machine Tool Corporation; "Industry Charts," by Mrs. Frida F. Selbert, secretary of the Association; "Tools for Peace," by Colonel Louis Johnson, Assistant Secretary of War; "Procurement Planning and the Machine Tool Industry," by Walter W. Tangeman, vice-president, Cincinnati Milling Machine Co.

The address by the Assistant Secretary of War Johnson was of especial interest at this time. As chairman of the Munitions Board, Colonel Johnson has first-hand knowledge of the needs of both the Army and the Navy. He came before the machine tool builders to outline the general plans for the United States armament program.

Engineering News Flashes

The World Over

Carboloy Gage Tests Over Four-Hundred Thousand Parts without Wear

The following example of long Carboloy gage life is reported by an Illinois manufacturing concern: A Carboloy ring gage, after being used for gaging 431,979 aluminum alloy spindles, 2 inches long, showed no measurable wear on the bearing of the gage. The mouth of the gage was worn slightly, but required regrinding of only 0.030 inch from both sides to recondition it for further use. The gage is made of solid Carboloy, 13/32 inch outside diameter and 1/4 inch thick, and has a 0.1285-inch diameter hole. The high-speed steel gages formerly used wore over size after gaging from 3000 to 5000 spindles.

New Type of Airplane Developed in England

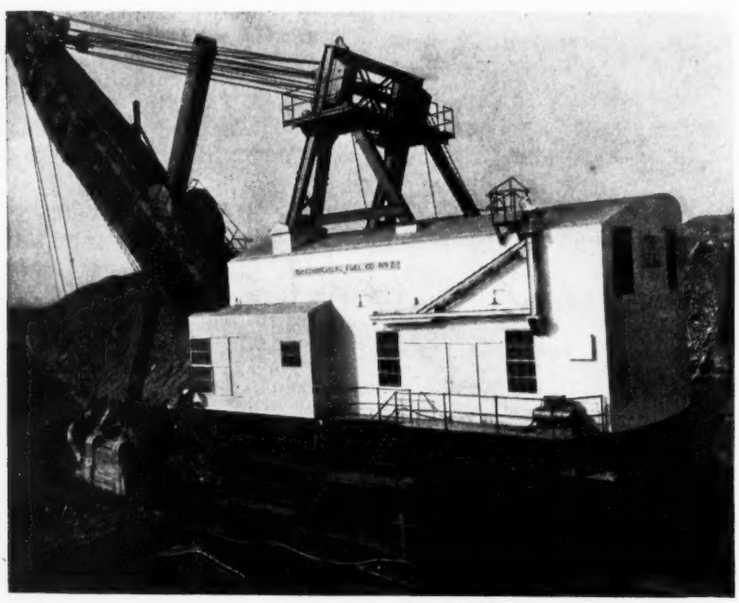
According to *Industrial Britain*, a new type of airplane has been developed by F. Hills & Sons, Ltd., Trafford Park, Manchester, England, which has been described as "the motor car of the air." This is a small plane equipped with an 80-horsepower engine. The object of the designer, Norman Sykes, is said to have been to produce an airplane with the comfort and facilities of an automobile. The plane has a large door on each side of the cabin easily entered from the ground. Inside the cabin, the controls, seating arrangement, windows, and rear-vision mirror are placed exactly as in a car. The plane has been subjected to tests, but nothing appears to be, as yet, available pertaining to the actual results obtained.

Uses of Copper in Egypt 5000 Years Ago

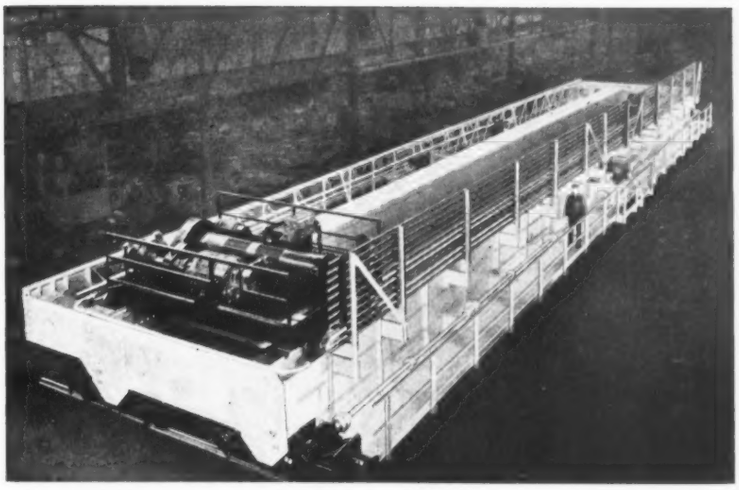
The Diorite quarries which were worked by the Egyptians at the time the great Pyramid was built, between 5000 and 6000 years ago, have been located. In these quarries, which have been buried by the sands of the desert since 1700 B. C., was discovered a heavy copper chisel. Some time ago there was found at Ghizeh, near the Cheops Great Pyramid, a length of copper tubing that had been used to convey water over 5500 years ago. The copper was undamaged by centuries of exposure and the tube still held water without leaking.

Facts versus Current Fancy

In planning to build over 2000 new cars for the underground railroads in London, England, the London Passenger Transport Board has made ex-



A Power Shovel Standing Almost 100 Feet High and Weighing 2,500,000 Pounds, which will Scoop up 40 Tons of Dirt with One Swing of Its Mighty Dipper. This Machine was Placed in Service by a Fuel Company in Pittsburg, Kan., to Remove the Top Soil from Veins of Coal Lying from 30 to 50 Feet Beneath the Surface. The Machine Had to be Shipped in Pieces, Forty-two Railroad Cars being Required to Transport it. In the Field Erection, Electric Welding was Used Extensively, Lincoln Electric Welding Machines and Electrodes being Employed. An Arc-welding Generator with Welding Accessories will be Carried on This Shovel as Part of Its Regular Equipment, for Repairing Broken or Worn Parts. The Welder may be Seen on the "Porch" of the Machine



A 15-ton, 120-foot Span, All-welded Mill Type Crane, Believed to be the World's Largest Span All-welded Crane. Ten of These Cranes are being Built by the Cleveland Crane & Engineering Co., Wickliffe, Ohio. All Major Sections, such as Girders, End Trucks, Cages, etc., are Fabricated by Welding, No Rivets being Used. Each Girder Weighs 72,000 Pounds. The Complete Crane Weighs 275,000 Pounds

tensive experiments to determine whether there would be definite advantages in building these cars on the streamline principle. The board's experiments have proved that, for service on the underground railways, there is no advantage, either in speed or in economy of operation, that would compensate for the loss of seating capacity in streamline cars. The new trains will have increased acceleration and more powerful braking than present models. They will accelerate to a rate of twenty miles an hour in ten seconds. Their braking capacity will be at the rate of three miles an hour per second.

Unusual Size of Heavy-Duty Truck Tires

The Goodyear Tire & Rubber Co. is making some unusually large tires for a manufacturer of large earth-moving vehicles. These tires, which when inflated at 75 pounds air pressure will have a load capacity of 25,000 pounds each, have an outside diameter of approximately 7 feet, and measure over 2 feet in cross-section. They weigh 1200 pounds each.

For the vulcanizing of the giant rubber casing, it was necessary to construct a special mold weighing 27,000 pounds, while for the tube alone, a mold weighing 10,500 pounds was needed. These tires are more than twice as heavy as the largest truck tires that have previously been made.

Krupp Constructs Giant Excavator

The Krupp Works in Germany have recently constructed, for one of the German brown-coal mines, what is believed to be the world's largest dredger excavator. This dredge has a rated output of 1,100,000 cubic feet every twenty-four hours, but under ordinary working conditions, it has actually handled this amount in sixteen hours, or at the rate of 1,650,000 cubic feet in twenty-four hours. The entire equipment, which consists of excavator with loading arrangement, is mounted on 128 wheels, forty of which are motor-driven, and runs on two parallel standard-gage railway lines.

Industrial Activity Increased in Great Britain in 1937

The industrial activity in the United Kingdom in 1937 was 6.8 per cent greater than in 1936. If production in 1930 is taken as a base index equal to 100, the industrial production in 1936 was equal to 124.6; in 1937 it rose to 133.1. It is stated that, as far as has been ascertained, the increase in production in 1937 in the United Kingdom represents a larger output, compared with 1930, than in any other large industrial country except Japan. The largest increases in 1937, compared with 1936, were in the production of iron and steel (11 per cent), machinery and shipbuilding industries (10.5 per cent), and non-ferrous metals (15 per cent).

World's Largest and Fastest Continuous Strip Mill

What is said to be the world's largest and fastest continuous strip mill was formally opened by the Republic Steel Corporation of Cleveland at its Cuyahoga Valley plant on March 15. This mill rolls strip steel up to 94 inches wide through a series of electrically controlled roughing and finishing mills to a coiler located almost a quarter of a mile away from the point where the slabs enter the first set of rolls. The time required for this is only four minutes.

The steel moves through this mill at speeds up to 2100 feet per minute in the final stage, before it is wound into coils weighing as much as 12,500 pounds each. The plant has a capacity for producing a million tons of hot- and cold-rolled sheet and strip a year, and has an employment capacity for over 2000 men. The capacity of the mill is for plate in widths from 30 to 94 inches, and in thicknesses from No. 18 gage to 1/2 inch.

EDITORIAL COMMENT

MACHINERY is a mechanical journal; it is not the practice to discuss political questions in these columns. There are times, however, when industrial activity is so definitely tied up with confidence or lack of confidence in the Government, that it is impossible to discuss the industrial recession intelligently without reference to political policies.

Permanent prosperity for the industries of the United States, which means permanent employment for labor, cannot be expected unless there is confidence in Government policies. Confidence in the Government is the first requisite of normal industrial activity.

There have been many causes for the recession in business that has occurred during the last few months, but among these, labor unrest, unreasonable demands on the part of labor leaders, methods of taxation that discourage industrial activity, and the Administration's hostile attitude toward industrial endeavor are the outstanding ones. All the remedies proposed and the most lavish spending of Government money will prove futile as long as the Government is unable to inspire confidence in its policies.

Government Fails when it Cannot Inspire Confidence

Were there complete confidence in the Government, there would be no need of Government spending in order to bolster up industrial activity. Such activity would come by itself. We have industrial leaders with ability, vision, and enterprise. We have workers with training and skill. We have a country unequalled in natural resources. Our industries could be the most active in the world, our people could enjoy the highest standard of living; but no such achievement is possible unless we have a Government that can inspire confidence.

Air-conditioning is becoming a more and more important factor in machine shop practice. The first example of air-conditioning in a machine shop was probably the case of the Pratt & Whitney Co., who installed a temperature-controlled department several years ago for making precision gage-blocks. Recently, however, air-conditioning has been installed in a number of machine shops in various fields. In some instances, the object has been primarily the comfort of the employes during the summer months, as in the plant of the International Business Machines Corporation at Endicott, N. Y.

In other cases, air-conditioning has been installed for the purpose of insuring greater accuracy of the finished product and aiding in the efficiency of machining operations, as well as providing comfort for the workers; several of the automotive plants, including the Ford Motor Co., are cases in point. Again, the object may be to exclude all dirt and dust in the final assembly of a mechanism, as in the case of sealed compressors at the Westinghouse East Springfield plant.

A New Industry that Provides Thousands of Jobs

Within the next few years, there will doubtless be hundreds of machine shops all over the country where certain departments, at least, will be air-conditioned to provide the best setting for efficient and accurate work and comfortable working conditions. The increased use of air-conditioning in the industrial field will add greatly to the demand for air-conditioning equipment, even though hotels, restaurants, theaters, and residences will probably remain the most important users.

Here is a new industry springing up that was not thought of as an important industrial factor even five years ago; yet today, thousands of people are employed in manufacturing and installing air-conditioning equipment, and a market is provided for manufacturing equipment and materials.

Contrary to the belief of many people unfamiliar with the methods and processes of industry, the increasing use of machinery in industrial operations has lightened the task of the worker. The machine performs much of the heavy work that was formerly done by muscular effort. Industrial progress has been made by better machines, better materials, and better methods; production has been increased by better machines rather than by increased effort on the part of the machine operator. That is what the machine is for. The machine has made this a better country to live in; it has raised the standard of living and reduced working hours.

The Machine has Made This a Better Country to Live in

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Simple Mechanism for Producing an Oscillating Motion in a Shaft

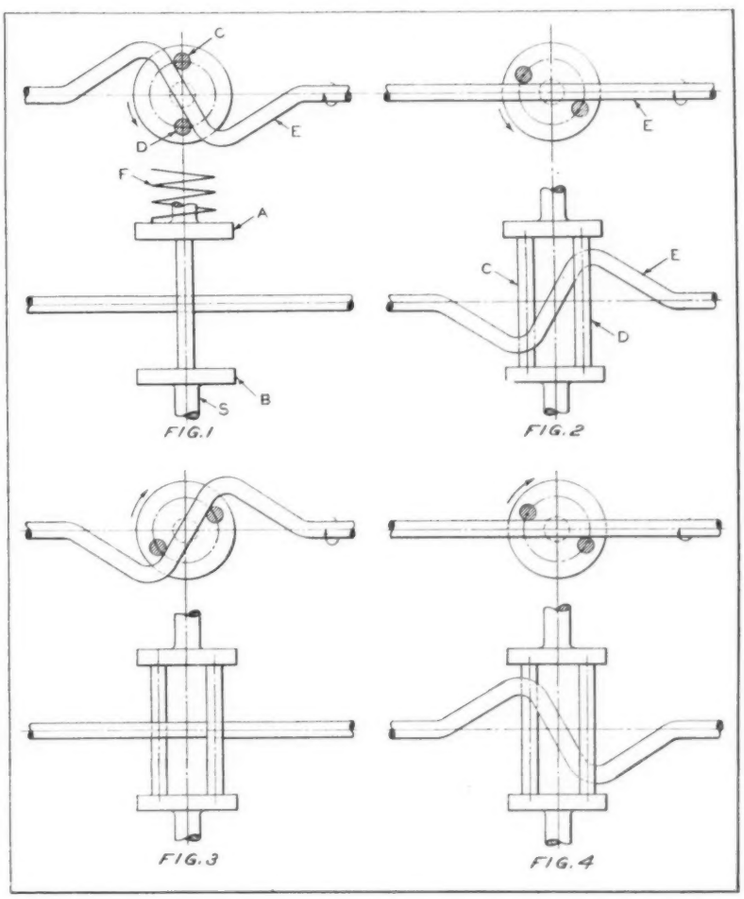
By JOSEPH WAITKUS

The mechanism shown in Figs. 1 to 4 was developed to produce an oscillating motion in the vertically suspended shaft *S* through the continuously rotating horizontal shaft *E*. It consists mainly of two disks *A* and *B*, both of which are a part of the vertical shaft assembly; the horizontal shaft *E*; spring *F*; and the pins *C* and *D*. The horizontal shaft *E* is bent to the shape indicated in the illustration, and is located between the pins *C* and *D*.

The four positions of the horizontal and vertical shafts shown in Figs. 1 to 4 indicate that the horizontal shaft serves as a cam, with the pins *C* and *D* acting as the cam followers. The shaft *S* is spring-loaded to keep the pins *C* and *D* in contact with the shaft *E*.

The mechanism can be operated at moderate speeds and, with a reasonable amount of tension in spring *F*, the oscillations will be imparted to the vertical shaft smoothly and without shock.

By changing the shape of the shaft *E*, sufficient variation in the oscillations can be obtained to meet different requirements. Some experimental work may be necessary when precise results are desired. However, a fairly accurate lay-out will usually be sufficient to give the desired action.



Figs. 1 to 4. Views of Oscillating Mechanism, Showing how Rotating Shaft E Transmits Oscillating Motion to Shaft S

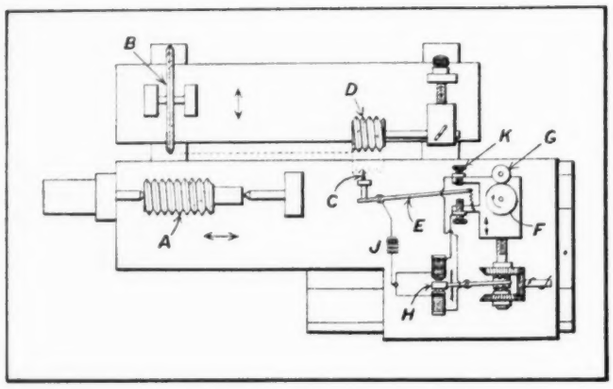
Electrically Controlled Mechanism for Milling Truing-Diamond Guide Cam

The mechanism shown diagrammatically in the illustration on page 678 performs two separate functions. Its first function is to mill a plate cam *F* for controlling the movements of diamond *C* in truing the abrasive wheel *B* to the correct form for grinding the thread on work *A*. The second function consists of the wheel-truing operation with the diamond *C*.

One of the problems met with in truing grinding wheels for form-grinding is the continuously changing profile of the diamond, due to wear. When the movement of the diamond in truing the wheel is controlled by a cam, the position of the diamond relative to the cam must be frequently changed to compensate for the change in the profile of the diamond. The mechanism shown, which is the invention of M. Fernand Turrettini of the Société Genevoise, provides means whereby the cam can be rapidly adjusted to suit the profile of the diamond.

The diamond *C* is arranged to move over the profile of the master *D*, being carried in a holder mounted on a lever *E* which is pivoted on the table about a vertical axis.

The wheel-slide is traversed until the master *D* makes contact with the diamond, which is then displaced one complete thread, contact being maintained by a spring at the end of lever *E*. The movement of the diamond is trans-



Electrically and Mechanically Controlled Mechanism Employed for Truing Thread-grinding Wheel

mitted by lever *E*, operating in conjunction with a servo-motor, to a rotary disk, or cam blank, *F*, which is thus moved toward the milling cutter *G*. The latter cuts a cam-shaped profile on the disk corresponding to the shape of the master *D* and the diamond actually in use. The speed of disk *F* must be the same as that of the work, as the movement of the diamond along one complete thread of the master corresponds to one revolution of the work.

The servo-motor drive consists of the bevel gears shown, arranged with an intermediate clutch to give a forward or reverse motion to the screw that moves the slide carrying cam *F* to or from the cutter. The actuation of the reverse clutch must follow exactly the movement of lever *E*, and to effect this, an electromagnet control is provided. The clutch-operating lever, pivoted to the table, supports an armature *H* between two electromagnets. One end of each of the magnets is joined to one pole of a source of current *J*, and the other end of the upper electromagnet is connected to an adjustable insulated contact, the lower magnet being in circuit with a second similar contact *K*. Interposed between these two contacts is a contact fixed to lever *E*.

To cut the cam surface on the periphery of disk *F*, the diamond is traversed to the root of the master thread *D*, when the circuit including the lower electromagnet is closed and the drive through the bevel gears causes the slide carrying the disk to traverse so that milling cutter *G* feeds into disk *F* as the diamond simultaneously moves along the flank and finally reaches the tip of the master thread. Arm *E* then engages the upper contact *K* and reverses the movement of the slide at the same time that the diamond begins to move down the other flank of the thread. Thus, during one revolution of the disk, a cam surface is produced corresponding to the thread of the master screw, the height of the cam profile being amplified according to the ratio of the lengths of the arms of lever *E*.

The cam is then used to control the movements of the diamond in truing the grinding wheel, the milling cutter being replaced by a roller having the same diameter as the cutter. At this time, the cam slide is disconnected from the screw drive and the lever *E* clamped by means of the two contacts *K*. The diamond is then brought to bear on the grinding wheel, the cam disk and the table are traversed at the same speed as before, and the diamond, through the medium of the cam and fixed roller, moves exactly as when engaging the master screw.

When the diamond has become worn so that it will not reproduce the profile of the master screw accurately, it is again traversed along the master so that the cam *F* is milled to correspond with the new diamond profile. B. M.

Intermittent Worm-Gear Mechanisms

An intermittent worm-gear that permits the worm-wheel to dwell about one-half the operating time is shown in the view to the left in Fig. 1. The worm consists essentially of a short piece of worm thread passing around the core or portion of the

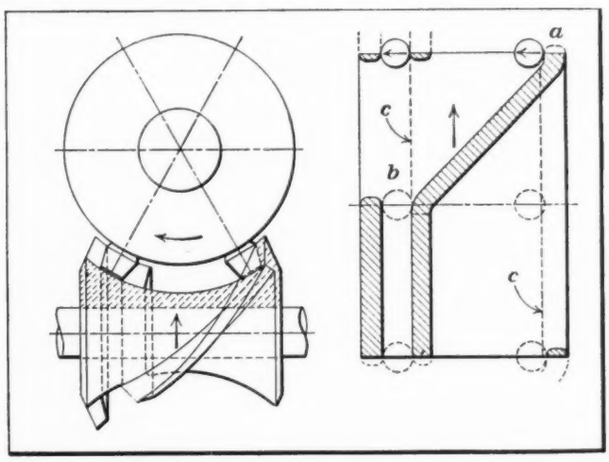


Fig. 1. Intermittent Worm-gear Drive in View to Left, with Development of Circumference of Similar Parallel Worm in View to Right

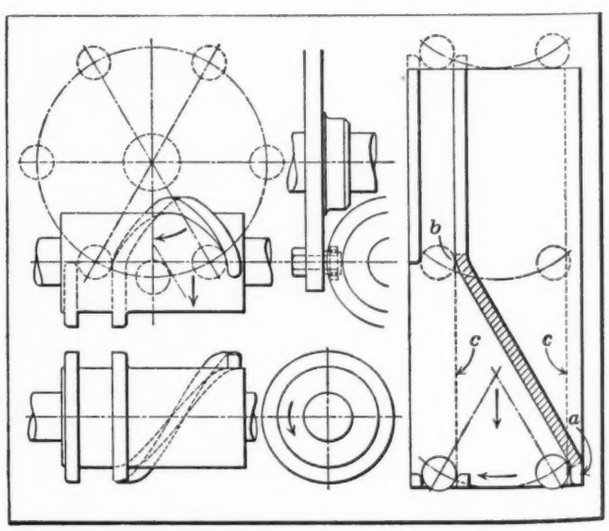


Fig. 2. Alternative to Design Shown in Fig. 1

worm between the dotted lines *c*, and an annular groove which serves as a guide and prevents the worm-wheel from rotating during its dwell periods.

To insure a gradual start, the forward ends of the thread should be formed as indicated at *a* or a loose piece should be attached to give the same effect. At *b* the thread might be modified to get a similar gradual "slow-down" motion. The worm must make six turns for each turn of the worm-wheel. As the worm-wheel must remain idle about one-half the time, the thread can extend only about half way round the worm.

The view to the right, Fig. 1, shows a duplicate of the pitch circumference of a parallel wheel which would give about the same results as the drive shown to the left.

Fig. 2 shows an alternative to the arrangement shown in Fig. 1. In the case of the worm shown in Fig. 2, the thread is machined on a cylindrical core and actuates a roller-toothed disk attached to the drive-shaft.

Irregular Reciprocating Motion

By L. KASPER

On a machine for manufacturing a wire product, it is necessary to guide the wire over a given path at an irregular rate of speed which decelerates toward the end of its travel. Although the required motion could readily be secured by the use of a cam, it was desired to obtain it from a crank used to operate another unit of the machine. The four views *E*, *F*, *G*, and *H* in the accompanying illustration show how this was accomplished.

The crank *A* rotates in the direction indicated by the arrow, a reciprocating motion being transmitted to the slide-block *C* through the connecting-rod *B*. Gear teeth, cut in the large end of rod *B*, mesh with similar teeth on lever *D*, which is carried on block *C*. The wire being guided passes through a hole in the upper end of lever *D*.

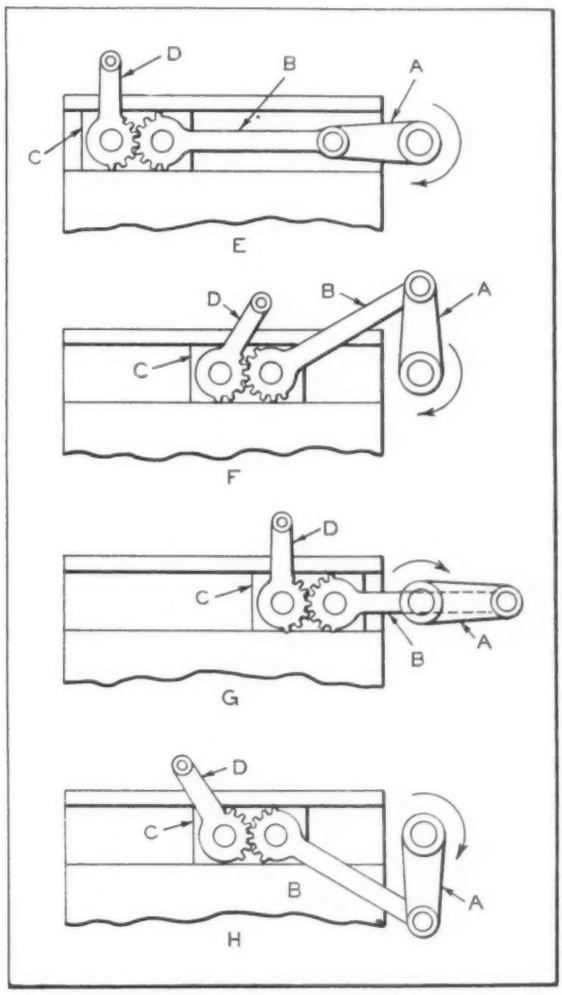
In operation, the mechanism starts with lever *D* in the position indicated in view *E*. The angular movement of connecting-rod *B* causes lever *D*, by means of the gear teeth, to oscillate on its stud, so that the movement of the upper end of lever *D* is added to the movement of the block *C* as produced by the rotation of crank *A*, thus causing lever *D* to assume the position shown in view *F*. Continued rotation of crank *A* carries rod *B* to the horizontal position, causing lever *D* to return again to a vertical position, as indicated in view *G*, the movement of the upper end of lever *D* being deducted from the movement of block *C*.

A comparison of views *E*, *F*, and *G* indicates that during the first quarter revolution of crank *A*, the movement of the upper end of lever *D* is considerably greater than in the second quarter. In view *H*, which shows the mechanism at the end of the third quarter revolution, the condition is the same as in view *F*, but in the reverse direction.

Taxes and American Progress

Tax policies adopted at this session of Congress will largely determine whether the present recession in business will continue or whether there will be substantial recovery. Under the title "Taxes and American Progress," the Machinery and Allied Products Institute has published the testimony that William J. Kelly, president of the Institute, presented before the Senate Finance Committee hearing on the revenue bill of 1938.

"The trouble has been," Mr. Kelly says, "that while our tax policies of recent years have been aimed to punish the so-called 'rich,' they have missed the target. . . . The result has been that the barrage has hurt the innocent bystander—the unemployed—more than anyone else. The determining factor in conditions today is the attitude in Washington toward business. The handling of the tax bill will be viewed by the country as an indication of encouragement or discouragement." Copies of the booklet can be obtained by addressing the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill.



Crank-operated Slide with Segment Gear Lever which is Given Irregular Reciprocating Motion through Segment Gear on Connecting-rod

The Machine Tool Exhibition at the Leipzig Fair

By ERIK OBERG, Editor, MACHINERY

IN the article in May MACHINERY, page 620, dealing with machine tools exhibited at the recent Leipzig Fair, the trend of present German machine tool design was indicated and a number of German machine tools of modern design were illustrated. The present article will give further examples of new types of German machine tools, and will deal briefly with some of the more unusual developments exhibited.

Indicators and gages provided as part of the machine were applied to a great extent. Several machines had indicators showing the pressure of the cut, thereby giving notice to the operator when the tools become dull and need resharpening. Some machines also had indicators showing clamping pressure. Indicators for gaging the work, built into the machine as part of the original design, were frequently seen. Lights are often arranged as part of the machine, to provide proper lighting of tools and work. On some machines, high tensile strength steel was used for ordinary fastening screws, in order to provide for smaller diameter of screws, thus requiring less space for the fastening means. This use of high tensile strength screws was in evidence not only in machine tool construction, but also in machine-building designs in general.

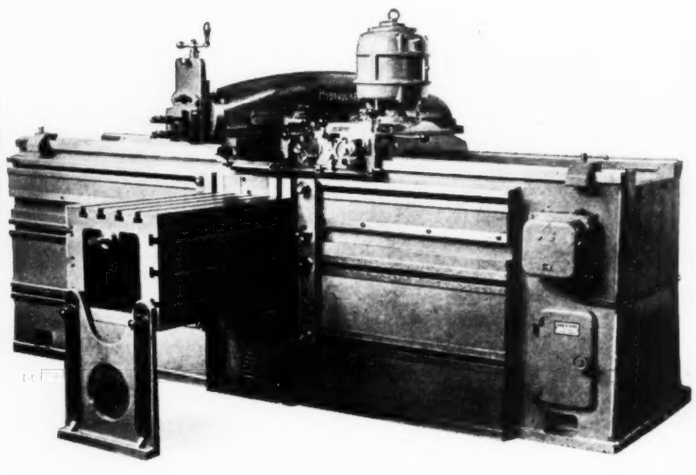
Very highly developed oxy-acetylene welding and cutting methods were demonstrated. Intricate shapes were cut to very close tolerances by automatic machines in which the flame was guided either by a former or by following the outline of a drawing laid on the table of the machine. Obviously, the design of machines of this type has been fostered by the general use of welded machine frames and beds. As noted in the preceding article, a great many machine tools, even those of standard design, were constructed by welding.

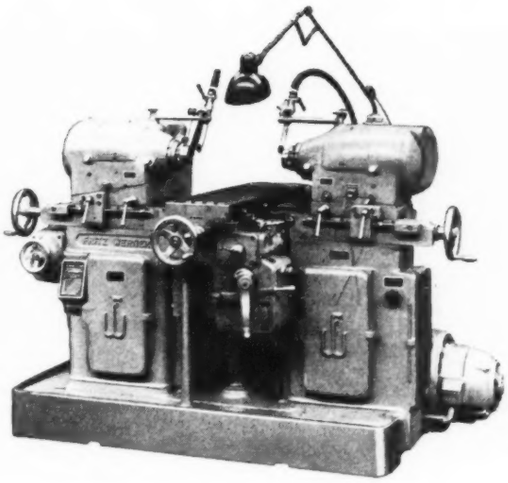
Surface-hardening, with the acetylene flame, of shafts, gear teeth, camshafts, sliding members, etc., has been highly developed, because of the need in Germany for saving in the use of the higher grades of steel; thus a cheaper steel may be used for machine parts and the wearing surfaces may be hardened by the flame method. Automatic and semi-automatic machines for this purpose were shown in operation.

Because of the scarcity of nickel in Germany, molybdenum is being extensively used as a substitute for nickel. Chromium-molybdenum steels are used to an increasing extent for spindles and gears, and have proved very satisfactory for this purpose. In the cast irons used for machine beds and columns, the nickel content has been reduced to a minimum or has been entirely eliminated as a mat-

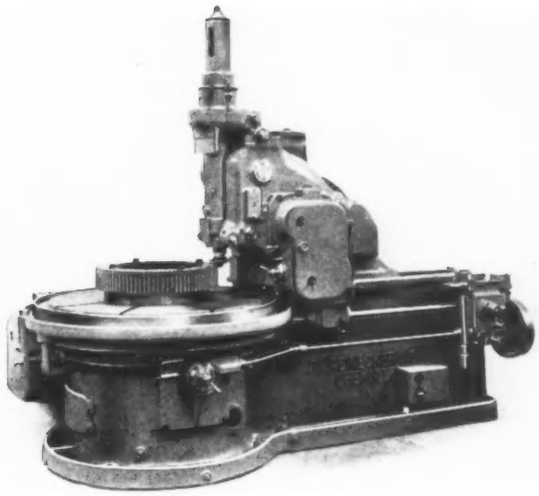
An Unusual Design of Horizontal Milling Machine Provided with Automatic Electric Control. This Machine was Exhibited by Biernatzki & Co. Maschinenfabrik

Hydraulic Shaper Built by Lange & Geilen in Sizes up to 40 Inches Stroke and up to 17 Feet Length of Bed. This Shaper is also Made with Two Heads Mounted on the Same Bed, and with Two Work-supports

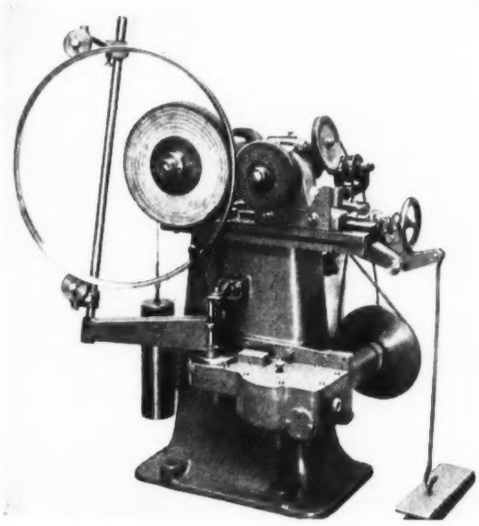




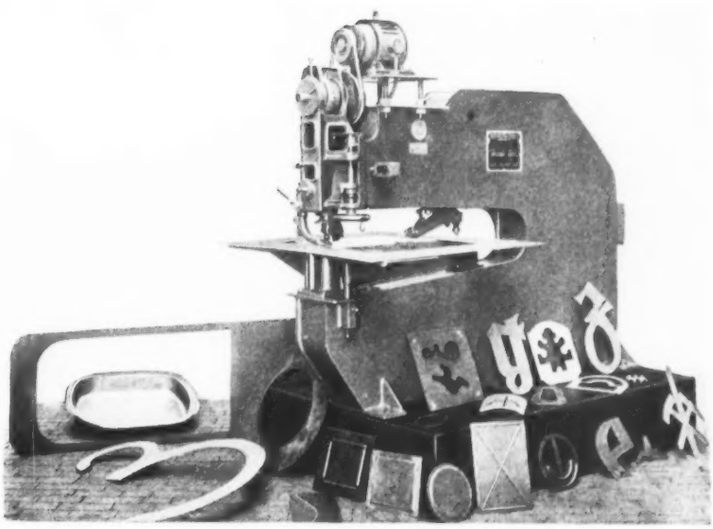
A Double-spindle Plain Milling Machine Built by Fritz Werner A.G., Embodying the Latest Improvements in this Type of Machine



A Reinecker Automatic Gear Shaper for External and Internal Spur and Spiral Gears up to 6 Feet in Diameter and 5 1/2 Inches Face

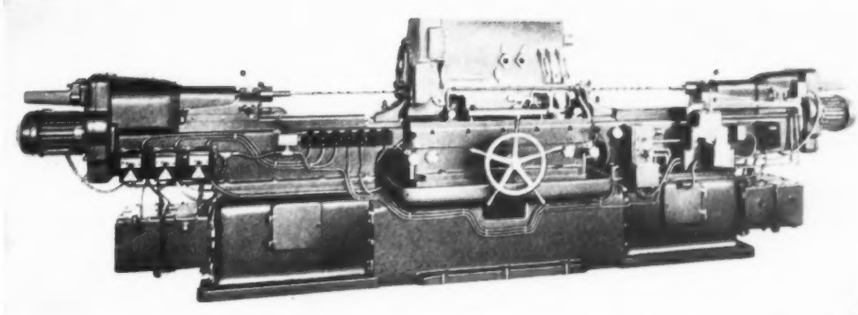


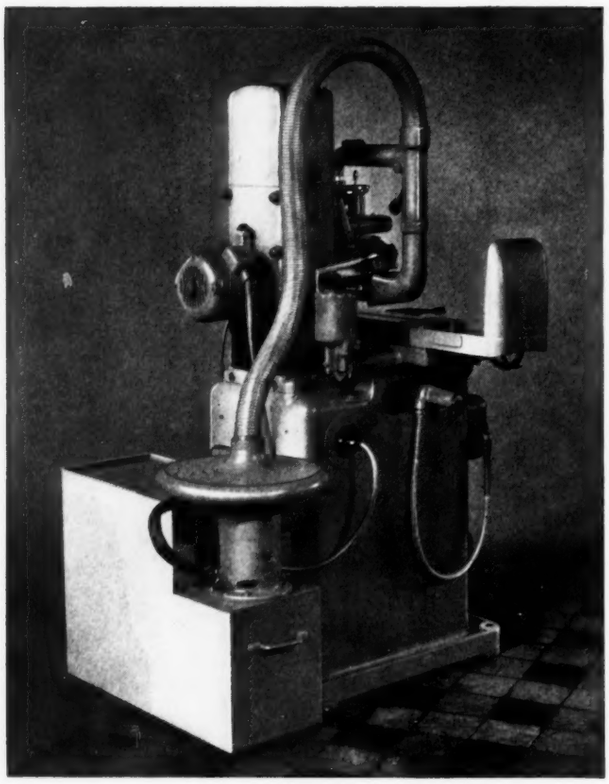
Centerless Polishing Machine Built by the Herminghausen Werke, which, by the Use of Simple Attachments, can be Applied to Various Kinds of Work



A Henry Pels & Co. Profile Shear, together with Samples of Work Performed on the Machine. This Shear is Built in Four Sizes, with a Maximum Gap of 3 1/2 Feet

Horizontal Deep-hole Drilling Machine with Two Opposed Spindles, Built by Huller Vorrichtungsbau and Exhibited by Hahn & Kolb. The Length of the Stroke of Each Head is 22 Inches. Each Unit has Electric Control and Hydraulic Feed





A Surface Grinding Machine Built by Karl Jung Maschinenfabrik. Note Means Provided for Carrying away Grinding Dust and the Protecting "Bellows" for Column Sliding Surfaces

ter of economy in the use of this metal. Improved rigidity is obtained by more careful design, proper arrangement of ribs, and careful selection of cross-sections.

Plain bearings are frequently made from centrifugal cast bronze of a fine grain structure providing good running and wear-resistant properties and great strength. Tests are also being made in the use of light metal alloys—aluminum and magnesium—for bearing purposes.

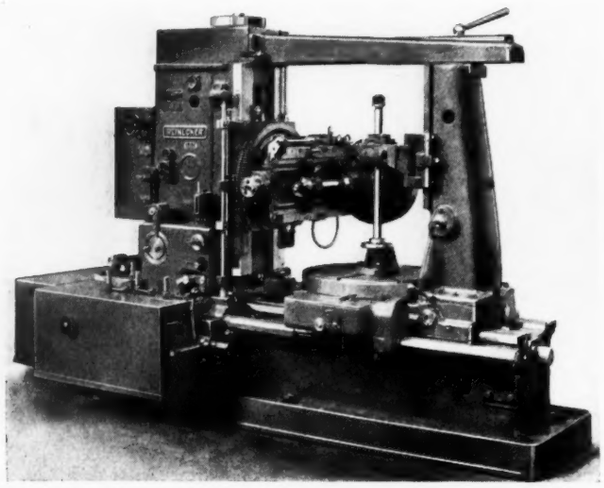
A machine differing radically from conventional design was exhibited by Gustav Göckel Maschinenfabrik, Darmstadt. The general appearance of this machine is shown in the upper right-hand corner of the opposite page, while in the center is a diagrammatic cross-section of the grinding wheel, work-table, and bed. This machine, known by the trade name "Rollschliff," is intended especially for the grinding of knives or cutters used in the paper, cardboard, cellulose, printing, leather, and tobacco industries. It can also be used, however, as a grinding machine for flat surfaces in general.

The unusual feature about this machine is that the head rests and moves on rollers along the bed, also being guided by rollers on the sides of one of the ways. The bed and work are stationary, while the wheel-head moves back and forth. The machine has two motors, one for the grinding wheel and one for the movement of the head. As will be noted, the bed is in the form of a trough which is filled with coolant, the latter being splashed over the surface being ground by a centrifugal "nozzle" without the use of a pump.

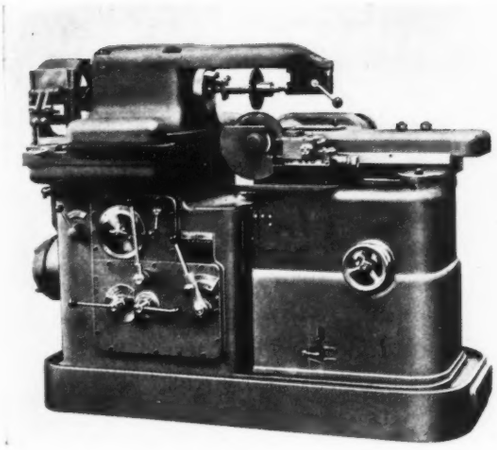
The bed is of welded construction with hardened and ground steel ways. The head is adjustable to an angle of 15 degrees in either direction for angular grinding. The table to which the work is attached is also adjustable to any angle through the operation of a handwheel and a graduated scale at the end of the machine.

In the previous article the application of a photo-electric cell, frequently referred to as the "electric eye," as a safety device on a shear was mentioned.

A Reinecker Automatic Universal Gear-hobbing Machine Made in Four Sizes, the Largest of which Hobs Gears up to 5 Feet in Diameter and 1 3/4 Diametral Pitch



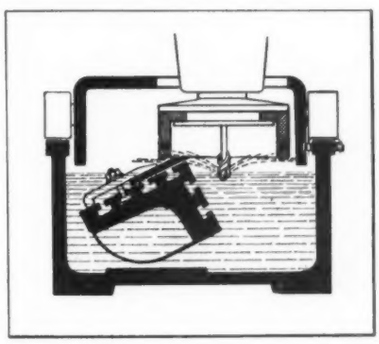
Cutting Spiral-bevel Gears with a Conical Hob on a Klingelnberg Hobbing Machine. Note Unusual Shape of Machine Bed, for Convenient Operation



A Hermann Kolb Gear Grinding Machine in which the Wheel Engages the Gear Teeth as if it were a Rack Tooth Moving in Engagement with the Gear. Both Sides of the Gear Tooth are Ground Simultaneously

An Unusual Knife- and Surface-grinding Machine in which the Grinding Head Moves along the Bed on Rollers, while the Work is Mounted Inside of the Trough-shaped Bed, as Indicated in the Diagrammatical Cross-section Below. Made by Gustav Gockel Maschinenfabrik

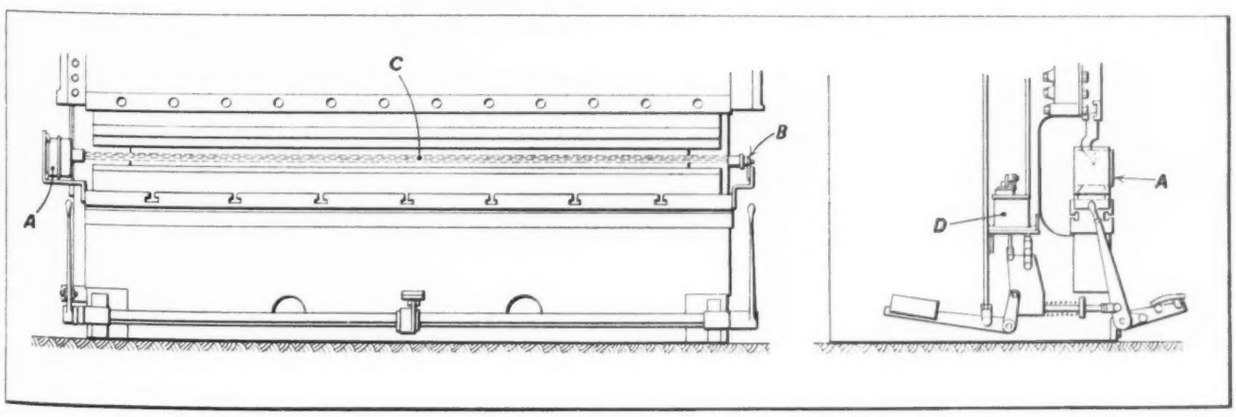
The machine to which this device was applied was a shear or edging press exhibited by Henry Pels & Co., Berlin-Erfurt, the principle being illustrated in the diagrammatic view at the bottom of the page. In this illustration, *A* is a source of light which throws a beam *C* along the full working length of the machine, this beam normally being projected to the photo-electric cell *B* at the right-hand end of the machine. If the beam of light is interrupted by the hands of the operator or any other object, an electromagnet located at *D* is actuated from the photo-electric cell through a relay and solenoid. This immediately disengages a friction clutch and operates a brake, which instantly stops the ram of the press. The arrangement in no way interferes with the normal operation of the press, since the sheet or plate to be operated upon can be manipulated without interrupting the beam of light. It is only when a wider object, like the hand, is placed in the path of the beam that the device becomes operative.



Diagrammatical Cross-section of Gockel Knife-grinding Machine

While, as mentioned in the previous article, there was only one American machine tool builder—the Cincinnati Milling Machine Co.—that exhibited at the Fair, there were several machines of American origin built under license by German machine tool builders, as, for example, Keller type diemaking machines. One of these machines was illustrated in the May number of MACHINERY, page 622.

Additional machines of more or less unusual design, seen at the Leipzig Fair, will be illustrated in a coming number of MACHINERY. The illustrations will give the American machine tool designer a general idea of the trends in the German machine tool industry.



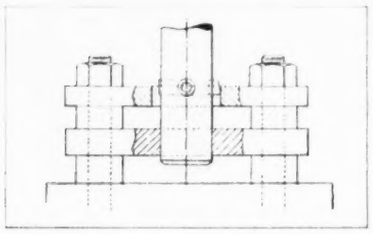
Diagrammatical View of Use Made of Electric Eye on a Pels Shear to Safeguard Operator's Hands

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Set-Up for Boring Plates

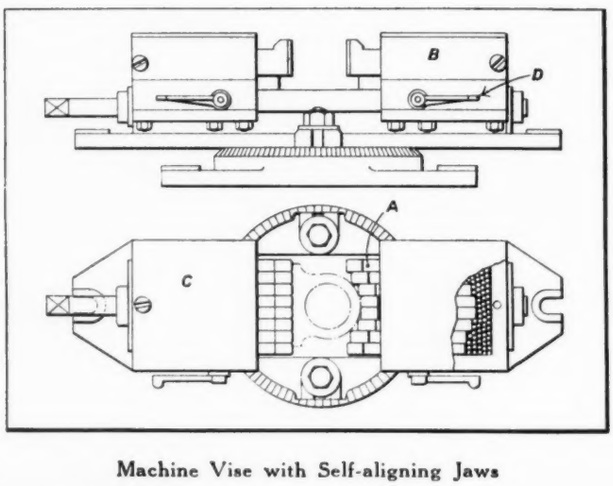
The set-up shown in the accompanying illustration was devised for use in boring three dozen plates after the side holes had been drilled. The boring-bar is guided by the plate located by the hold-down bolts, the spacing collars providing the necessary clearance above the table. The central hole, which had been previously rough-drilled, is finish-bored to size with a cutter mounted as shown. F. H.



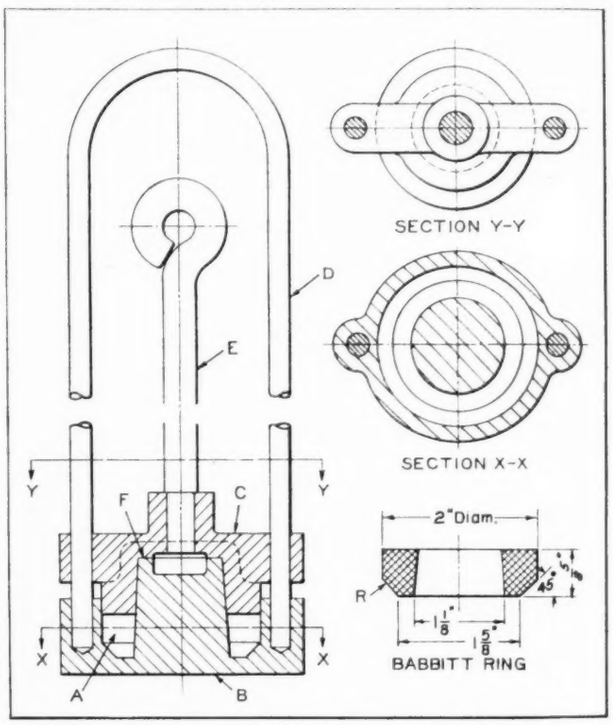
Set-up Used in Boring Rough-drilled Holes in Plates

Machine Vise with Self-Aligning Jaws

Small steel balls are used in a novel manner to obtain self-aligning features for the jaws in the European-made Berjo machine and bench type vise. A typical design is shown diagrammatically in the accompanying illustration. The self-aligning action of the jaws permits irregular-shaped work to be gripped securely without the use of special packing pieces. The compensating jaw comprises a number of steel strips *A*, mounted in a sliding housing *B*. Behind the strips there is a space which is completely filled with steel balls, enclosed by a steel cover *C*. As pressure is brought to bear on the work between the jaws, the strips follow its contour, whether plain or irregular, causing the balls to be displaced accordingly. Before reloading, the strips can be quickly reset by levers *D*. B. M.



Machine Vise with Self-aligning Jaws



Dipping Mold for Babbitt Rings

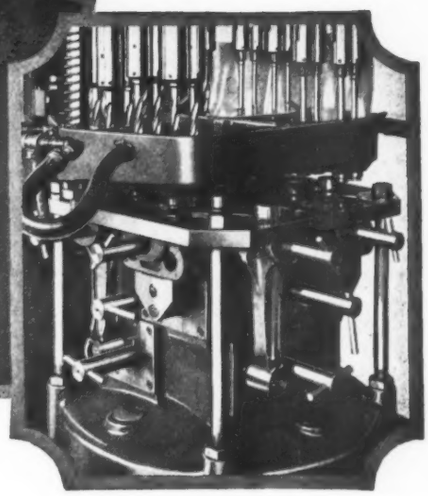
Mold of Dipping Type for Babbitt Rings

Circular babbitt rings like the one shown at *R* in the accompanying illustration are cast in the dipping type of mold shown at the left. The receptacle *B*, which holds the hot metal in the space *A*, is made of steel and has a handle *D*. The circular-shaped piece *C* that fits the inside of the mold *B* and forms the top side of the cast ring, rests upon the shoulder at *F*, thus assuring the production of rings of uniform thickness.

The handle *D* is bent to the U-shape shown and is fastened to mold *B*. The sides of the cavity *A* in the mold are made slightly tapering to allow the babbitt rings to be drawn from the mold after cooling. The mold is simply dipped into the melted babbitt with the part *C* raised high enough to allow the babbitt to enter the space *A*. The member *C* is then lowered until it reaches the stop *F*.

Holden, Mass. J. R. WHITTLES

Design of Tools and Fixtures



Concave Radii Truing Device for Grinding Wheels

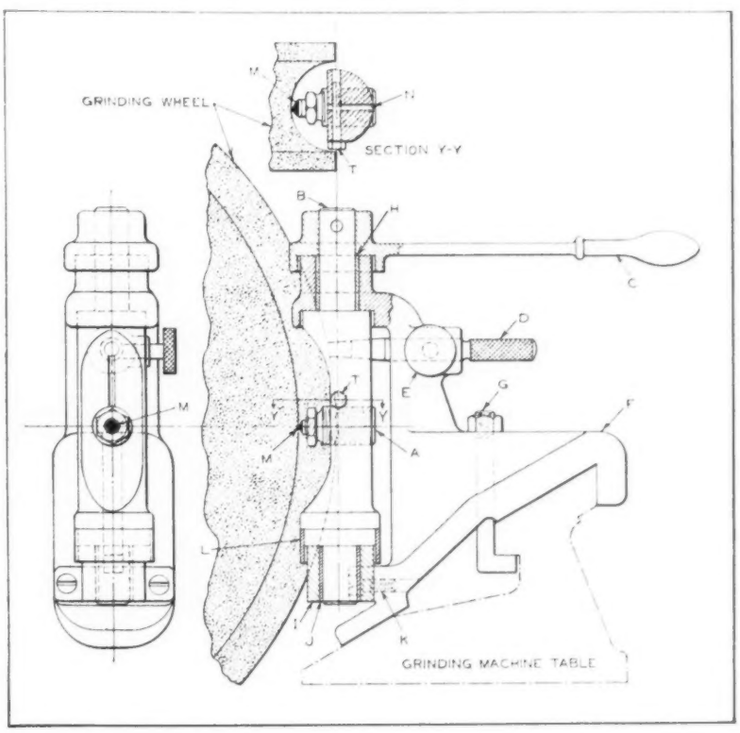
By J. R. WHITTLES, Holden, Mass.

The accompanying illustration shows a fixture for truing abrasive wheels to a concave radius form. The diamond nib *M* is held in a screw *A* which can be adjusted for truing concave grooves of different radii on the peripheries of grinding wheels. The upper and lower bearings of the vertical holder *B* provide rigid support for the diamond and make it possible to take heavy truing cuts without producing chatter marks on the surface of the wheel.

Holder *B* is swiveled about its axis by means of lever *C*. When it is rotated or swiveled, the diamond trues or forms a concave groove in the face of the grinding wheel, the radius of which is determined by the adjustment of screw *A*. To true a straight or cylindrical surface on the wheel face, holder *B* is locked in a fixed position by inserting the taper pin *D* in a tapered hole in the holder and securing the pin in place by tightening the knurled-head screw *E*. The grinding wheel rotates in a fixed position while the diamond and the grinding machine table are moved past the face of the wheel, in truing a straight surface. The cross-feed of the grinding machine is used to feed the grinding wheel toward the diamond.

The moving parts of the fixture are protected from the grinding lubricant and grit. The casting *F* that forms the body of the fixture rests upon the grinding machine table, to which it is bolted by the hook-bolt *G*. It has a bearing at the top containing a bushing *H* which fits holder *B*, another bearing for the pin *D*, and a bearing for the knurled thumbscrew *E*. A separate bearing *I*, containing the bushing *J*, is fastened to the bottom of the body *F* with two fillister-head screws *K*. It is lined up and bored in the assembled position to insure accurate alignment with the bearing at the opposite end.

Holder *B* is made of steel, and is turned down at the ends to form bearings and a shoulder for locating the water guard *L*. The adjusting screw *A* is located in a threaded hole



Device for Truing Radius-formed Groove in Face of Grinding Wheel

in the center of the holder. The diamond nib *M* is placed in a drilled hole in the head of screw *A* and is held in place by a headless set-screw set in the flat side of the hexagonal head of the screw. A saw slot *N*, which joins the tapered hole for pin *D* and the threaded hole for screw *A*, allows the threaded screw *A* to be clamped in place by tightening screw *T*. The hand-lever *C*, pinned to holder *B*, is counterbored to form a skirt, which extends downward over the upper end of casting *F* and thus prevents dirt or water from entering the bearing or bushing *H*.

Fig. 1. Top of Cocktail Shaker with Formed Spout D of Unusual Shape

Drawing a Shell of Unusual Shape

By M. J. GOLDSTEIN, New York City

The most interesting, as well as the most difficult, problem involved in the production of the cocktail-shaker cover shown in Fig. 1 is the forming and trimming of the brass shell *D* which serves as the body of the spout. The four dies made by the writer for producing this particular part are shown at *A*, *B*, *C*, and *D*, Fig. 3. The shape to which the shell is drawn or trimmed by each of these dies is indicated by the views at *A*, *B*, *C*, and *D*, Fig. 2.

The finished shell as it comes from the trimming die *D*, Fig. 3, is shown at *D*, Fig. 2. View *E* shows the completely assembled spout, consisting of the polished and buffed shell *D*, the brass end piece *J*, and the closing cap *K*. The brass end piece *J* is threaded to fit the closing cap and is soldered to the shell *D*. Both the end piece and the closing cap are produced on a screw machine from brass bar stock. The complete spout is soldered to the cover *H*, as shown in Fig. 1.

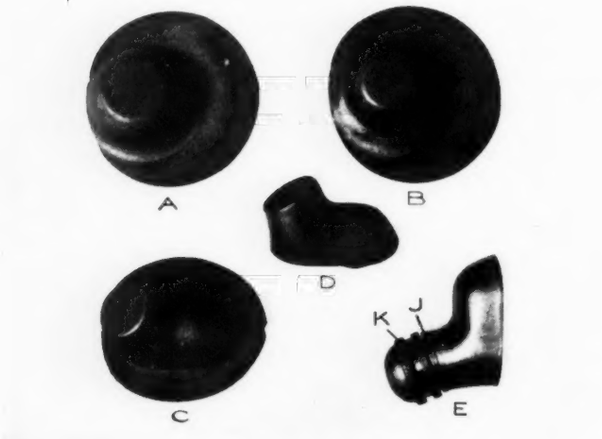


Fig. 2. Steps in Forming Spout D, Fig. 1, from Sheet Brass

The size and the shape of the shell *D*, Fig. 2, are shown by the two views at *W*, Fig. 3, the view to the right showing clearly how the base of the shell is trimmed to fit the cylindrical body of the cover, which has a diameter of 4 inches.

As the highest point of the shell is off center, it was necessary to make the die for the first drawing operation eccentric to the blank diameter, as shown at *A* and *F*, Fig. 3. The blank is 2 3/8 inches in diameter and is punched from 24-gage (0.020 inch thick) brass stock.

In the first operation, the shell is drawn to a depth of 7/16 inch by the die *A*, Fig. 3. The drawn part of the resulting shell shown at *A*, Fig. 2, is 1 1/8 inches in diameter and is set 3/8 inch off center to avoid excess pressure on one side of the pressure ring and breakage of the shell. The surface of the ring is relieved 0.003 inch, leaving a pressure surface 2 inches in diameter concentric with the drawn part, as indicated by the dotted lines at *G* in view *F*, Fig. 3. The cutting or blanking ring is concentric, but to avoid any possibility of movement, it is dowel-pinned in place. The punch is also dowel-pinned to the cast-iron holder. It is necessary to anneal the brass shells after the first operation has been performed.

The second-operation die is shown at *B*, Fig. 3. This die was first made as an ordinary reducing die, but it did not work properly until the pressure surfaces of the drawing ring and the punch were changed to an angle as shown. Before this was done, the shells broke at the high point when the reduction was brought down to the point required. One of the pressure pins was brought through the ring and allowed to project 1/8 inch above the surface, as shown, to support the shell properly when it is placed on the ring.

The reduction of the shell is brought down to the flat surface. The result is shown at *B*, Fig. 2, where the development of the angle is clearly shown. Due to the change made in the angularity of the pressure surfaces, breakage is not only prevented, but the drawn portion is formed to an angle of approximately 25 degrees to the base line. This helped greatly in the following operation.

The next operation, performed by the die shown at *C*, Fig. 3, formed the shell, and in addition formed the edge to the 2-inch radius required to fit the side of the cover *H*, Fig. 1. The face of the punch and the top surface of the pressure ring of this die were machined to an angle of 5 degrees. In addition, the radius for forming the edge of the shell is incorporated in these two surfaces. Two 1/4-inch dowel-pins were placed in the pressure plate for use in setting the die. These pins are not shown.

Two pins, only one of which is shown at the left of the pressure plate, are provided for the purpose of locating the blank and preventing it from slip-

ping when the punch first makes contact with it. In addition to the oval opening in the punch, a piece is inserted for the proper forming of the neck of the shell. The formed shell is shown at *C*, Fig. 2.

The slight wrinkle developed in the flange may be disregarded, as the entire flange is trimmed off. For the three operations described, pressure is applied to the blank by a rubber pressure pad or barrel, 4 inches in diameter by 8 inches long. No trouble is experienced from broken shells when this equipment is used.

The die shown at *D*, Fig. 3, for trimming the

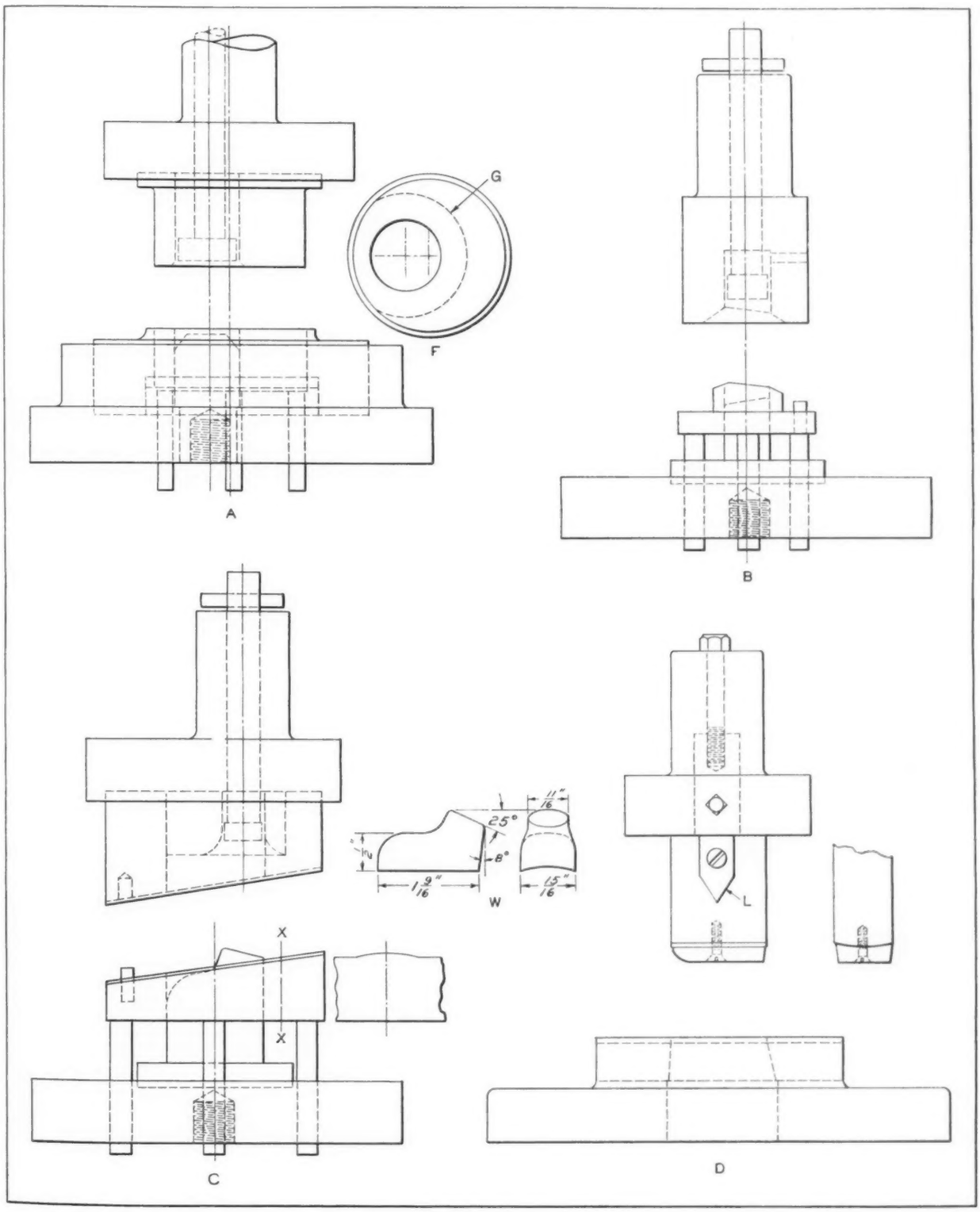


Fig. 3. Outline Views Showing Shape of Punches and Dies Used in Forming and Trimming Spout to Shape Shown at D, Fig. 2

flange is of simple design. While it has the usual 1-degree clearance, such as the writer ordinarily allows on dies of this type, one end has an added clearance of 5 degrees, beginning 1/8 inch below the cutting edge. This allows for the inclination of one side of the shell.

Of course the shells are placed uniformly on the trimming die. The surface of the die is formed to a radius of 2 inches, and the punch is also formed to this radius at the cutting edge. A pilot is attached to the face of the punch to assist in giving a clean-cut edge. Two knives *L* are attached to the punch. These knives cut the scrap material, so that it falls away from the punch.

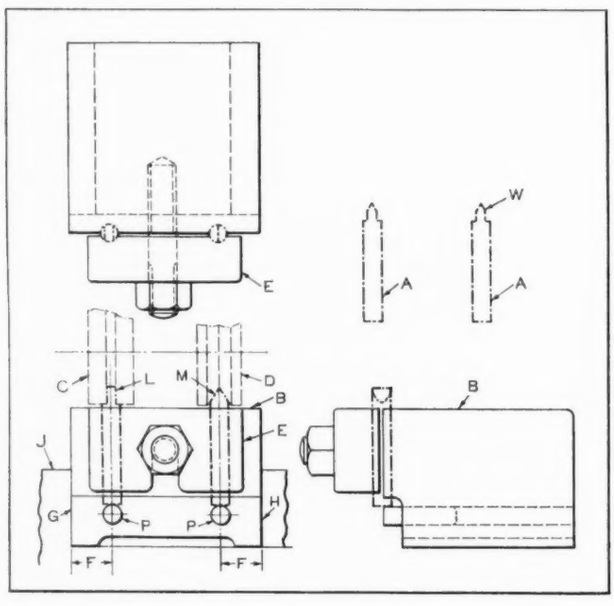
An ordinary perforating die (not shown) is used to punch the opening in the neck of the spout. This die has a nest for locating the shell in position. After this operation, the shells are ready for the soldering in of the threaded brass part produced on the screw machine.

Two-Position Reversible Fixture for Double Milling Operation

By C. COLE, Dayton, Ohio

The formed ends *W* of the pieces shown at *A* in the accompanying illustration are milled to shape in two passes of the work-holding fixture *B* beneath the milling cutters *C* and *D*. The simple fixture and standard milling cutters obtained from the regular stock in the tool supply room solved the problem of keeping the tool cost low, as required by the comparatively small number of pieces produced.

The fixture consists of the body *B* with half-round grooves milled in the end to fit the pieces *A*.



Fixture that can be Turned End for End to Bring Two Pieces of Work under Both Milling Cutters

Similar but shallower cuts were milled in the clamp *E*. The stop-pins *P* are located the same distance from the bottom of the fixture and in line with the locating grooves.

Two passes of the work under the cutters are required to produce two completed parts. The fixture is clamped in the milling machine vise with the edge *G* against the stationary jaw *J*. The work is then placed in the grooves and clamped in position with clamp *E*. The first pass of the work under the cutters forms the ends to the shapes shown by the dot-and-dash lines at *L* and *M*. The milling machine vise is then unclamped, leaving the work still secured in the fixture. The fixture is next turned end for end and clamped in the vise so that the edge *H* is against the stationary jaw *J* of the vise. The work is now passed under the cutters again, which completes the forming operations as shown at *A*. The dimensions *F* must be exactly alike, so that the proper relation between the two cuts will be maintained.

* * *

Rigid Wage Rates and Costs

The retarding effect of rigid wage rates on business recovery and employment is discussed in a study prepared by Allen W. Rucker in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. In this study, it is pointed out that the theory that high wage rates increase purchasing power and that higher wage rates generate still more purchasing power, in a sort of economic perpetual motion operation, has received a rude shock. Although hourly earnings at the close of 1937 were 12.2 per cent higher than at the close of 1936, the actual weekly earnings, because of a reduction in the average work week, were 8.5 per cent below December, 1936, and the number of workers employed was 7.5 per cent less. The booklet can be obtained by addressing the Farrel-Birmingham Co., Inc., Ansonia, Conn.

* * *

General Electric Plant Wins Safety Award

Because of its outstanding safety record during 1937, the West Lynn works of the General Electric Co., Lynn, Mass., was awarded the "Associated Industries of Massachusetts Trophy" by the Massachusetts Safety Council. The presentation of the trophy, a 2-foot plaque, took place at a recent convention of the Massachusetts Safety Council in Boston. The factors considered in the contest were man-hours of operation, degree of hazard, frequency and severity of accidents, and the percentage of improvement. The West Lynn works had only three lost-time accidents during 1937, despite the fact that 2600 people worked a total of 5,148,388 hours.

Casting and Carving Parts for Models from Plastics

By M. JACKER

PARTS for mechanisms that are to be used for experimental, engineering, and exhibition purposes can be easily cast and carved from inexpensive homemade plastic materials such as described in this article. For example, a small experimental differential gear consisting of four miter and four spur gears, which measured 2 1/2 inches between the bearing blocks, was recently made up from such materials without using a lathe, drill press, or gear-cutter. Nevertheless, this inexpensive model demonstrates the operation of the differential gear as satisfactorily as though it were a $50 model of all-metal construction.

The plastic composition is, as far as the writer knows, original with him and is published here for the first time. The materials required in making the plastics are 1 pound of paraffin, 1 pound of rosin, and 1 pound of kaolin—Chinese whiting. Our regular whiting may be used, but the writer has found that it is twice as heavy as kaolin. The rosin gives the mixture greater hardness and can be omitted when a somewhat softer and more easily worked material is desired.

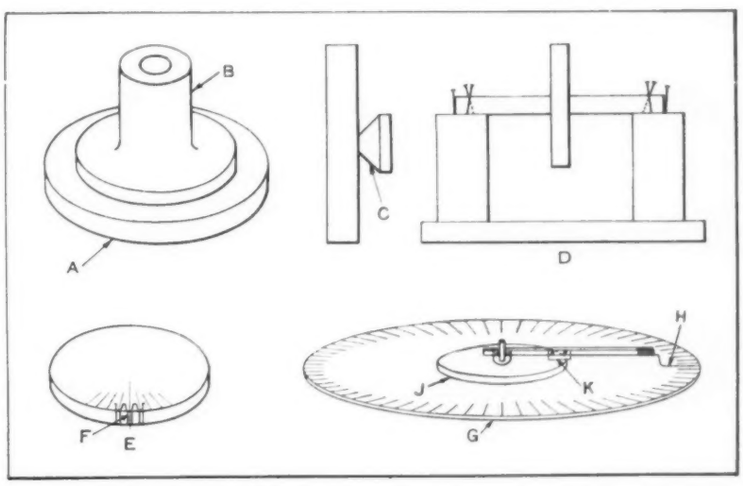
It is well to mix up a small amount of the material for experimental purposes before proceeding to mix the whole batch. This can be done as follows: First melt 5/8 ounce of paraffin in a small tin box, and then stir in 1 3/8 ounces of kaolin. Do not allow the temperature of this mixture to rise higher than necessary, or it may burn and discolor the kaolin. A good plan is to cover up the mixture and set it in a pan of boiling water. This is also the best way to reheat congealed batches of the mixture. As soon as it is cool enough, the mixture is kneaded in the hands for a few minutes. If properly made, it should stretch when pulled apart, and then break with a snap. If a small piece is held tightly in the hand for a few minutes so that it is warmed to blood heat or about 100 degrees F., it becomes soft enough to be worked.

The harder grade is made by melting 3/8 ounce of paraffin and 7/8 ounce of rosin, and stirring these ingredients until they are well mixed, after which 1 3/8 ounces of kaolin is added. This composition takes a very high polish.

These plastics can be colored by mixing with them the best powdered paints that are obtainable at a paint store. For a small red batch, melt 5/8 ounce of paraffin and stir in thoroughly 3/4 ounce of red powdered paint and then add 1 3/8 ounces of kaolin. Like all plastics, considerable pressure is required to unite two pieces, even though the mixture kneads well. Therefore, if any uniting is to be done, the pieces must be heated. This can be done by holding them in warm water for a few minutes.

The blanks for all the gears for the mechanism mentioned were made by squeezing the softened plastic into forms produced by bending a strip of tin of the proper width in a circle and securing it to a board with three pins. The inside of the forms should be slightly greased. After the forms have been filled, they should be cooled off in cold water. The tin is then removed from the blank by parting with a penknife. If a number of gear blanks like the one shown at *A* in the accompanying illustration are to be drilled for their shafts, it may be well to make a jig *B* of the same material for use in drilling the hole square with the side of the blank. A machinist's twist drill is used for drilling. The drill should be withdrawn frequently to permit removing the chips.

Hubs of small gears can be carved integral, while on larger gears, the hub member is attached by first chamfering, as shown at *C*, and then filling in with plastic, using a hot flattened wire. If a lot of this kind of work is to be done, the wire may be attached to the end of an electric soldering iron for heating the parts to be attached or an electric pyro art point might be used. The same method is employed for repairing broken teeth or other parts of a model. Long slender pieces can be reinforced with wire cores.



Diagrams Illustrating Methods Employed in Making Parts for Models from Homemade Plastics

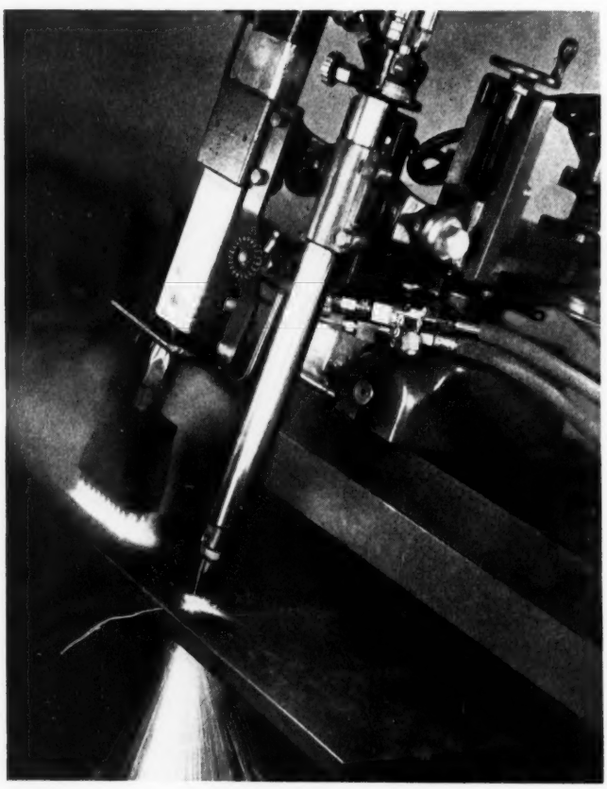
The faces and profiles of all gears are carved and scraped to size with a penknife, using a truing-up arrangement such as shown at *D*, by alternately spotting and carving. The same procedure is followed in making the bevel gears, with the exception that the blank must be carved to fit a templet of the proper bevel angle. Division lines are scribed on the face and periphery for the tooth centers, as shown in view *E*. These lines serve as a guide in carving the teeth, as shown at *F*.

For divisioning or spacing the teeth on gears up to 2 or 3 inches in diameter, a cardboard disk *G*, about 12 inches in diameter, may be used. This disk is graduated into the same number of spaces as there are teeth in the gear. A wire pointer *H*, secured to a pine stick which can be rotated on a shaft projecting upward from a board on which the cardboard disk *G* and gear blank *J* rest, is provided with a properly cut and shaped tin templet *K* for guiding the needle used in scribing the lines for the tooth centers.

The tooth center lines can be scribed on only one side or face of the gear blank in the manner described, but they may be transferred to the circumference and opposite face by eye. A scraper in the form of a tooth templet can be made from an old clock spring. In scraping the tooth space, the best results will be obtained if the temperature of the plastic material is kept low by cooling it off in cold water. If stronger plastic materials are required, there are now many excellent grades on the market from which to choose. Most of our modern combs, fancy buttons, buckles, and knife and toothbrush handles are made of these plastics. One need only try a knife on these materials to determine their carving qualities.

Flame-Softening

Most steels can be flame-cut without detrimental effect, but there are some harder grades of steel, particularly the low-alloy high-strength types, which tend to harden along the cut edge as a result of the cutting operation. A new process, known as flame-softening, provides a simple and economical means for restoring the steel to its soft condition.



The Cutting Torch is Followed by a Multi-flame Heating Head which Softens or Anneals the Steel after the Cutting Operation

Multi-flame heating heads, which usually operate simultaneously with the cutting, as indicated in the accompanying illustration, heat the body of the metal after cutting, so that the cut edge is annealed or tempered. In the illustration, published by the courtesy of the Linde Air Products Co., New York City, a low-alloy structural steel plate, 1 inch thick, is shown being softened by means of a thirty-flame heating head immediately after the cutting operation.

* * *

Summer Meeting of the Society of Automotive Engineers

The summer meeting of the Society of Automotive Engineers will be held at the Greenbrier Hotel, White Sulphur Springs, W. Va., June 12 to 17. During this meeting, sessions will be held relating to all the important phases of automotive design, including aircraft engines, Diesel engines, passenger car engines, passenger car bodies, fuels, lubricants, and detonation. For complete program, address the Society of Automotive Engineers, 29 W. 39th St., New York City.

* * *

Machine Tool Distributor Stages Machine and Welding Show in Boston

The Austin-Hastings Co., Inc., 226 Binney St., Cambridge, Mass., distributor of machine tools, metal-working machinery, and welding equipment, announces that the company will conduct a machine tool show at the Boston Garden Exposition Hall at the North Station, Boston, Mass., from 9 A. M. to 9 P. M., June 8 to 11, inclusive. The machines and products of more than a score of well-known manufacturers will be exhibited, all the machines operating under power.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

P. R. P.—What is the legal liability of a railway company when shipped machinery is destroyed by fire?

Answered by Leo T. Parker
Attorney-at-Law, Cincinnati

Generally speaking, a common carrier is liable for all losses excepting those caused by an act of God, such as lightning, or "inherent" damages of the machinery itself. However, the law is different after the machinery is placed in the railway company's warehouse awaiting call, due notification having been given of its arrival. Under the latter conditions, the carrier is not liable for damage to, or loss of, machinery where it is shown that the carrier employed a watchman and used other precautions to prevent the fire. [See cases: 8 S.W. (2d) 756; 264 Pac. 534; 157 N.E. 136; 148 Atl. 641.] The carrier exercises the degree of care required by law, which, as expressed by various courts, is "ordinary care" to safeguard the machinery, when it employs a watchman and uses modern fire fighting equipment. If the fire occurs during the day, the legal question may arise whether the carrier used ordinary care to prevent the fire.

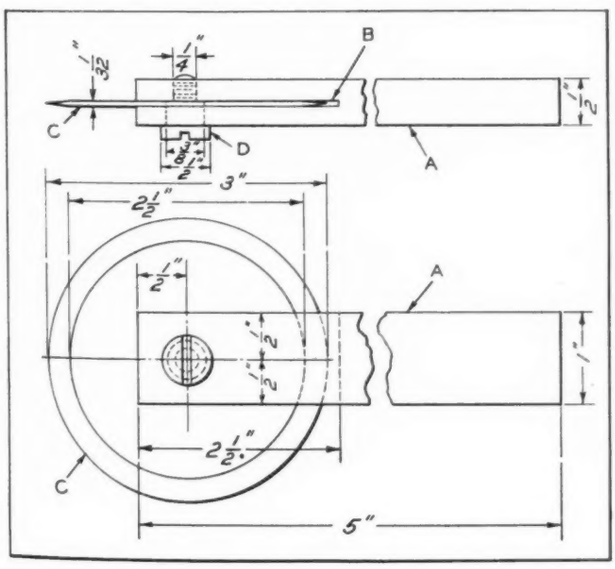
Tool for Cutting off Fiber Tubing

L. M.—We have had considerable trouble in cutting off fiber tubing in a lathe from the material tearing. Do any of the readers of MACHINERY know of a method of grinding the cutting-off tool that will overcome this difficulty?

Answered by E. D. Dunning
Dunning Mfg. Co., Philadelphia

A disk cutter with a thin sharp edge like the one shown in the accompanying illustration probably provides the best means for cutting off fiber tubing. The particular cutter shown has been used successfully on a screw machine for cutting off fiber tubing of small size, such as is used in making bushings for electrical equipment.

The holder *A* can be made from any piece of cold-rolled steel that will fit the toolpost. The slot *B* at one end of the holder is made with a cutter of the same thickness as the disk to be used as the cutter *C*, which should be about 1/32 inch. The shoulder screw *D* should be made from tool steel and should be hardened to form a bearing on which the disk cutter can revolve. The cutter can be made from an old cutter disk, ground to a fine sharp edge.



Revolving Disk Cutter for Cutting off Fiber Tubing

Annealing Castings to Relieve Stresses

N. C.—Can you give us any information on the annealing of castings merely to relieve strains and not to alter the mechanical properties? The castings under consideration are large sprockets and pulleys, pistons for Diesel engines, etc.

Answered by Editor, "Nickel Cast Iron News"

For annealing castings merely to relieve stresses, without materially affecting the physical properties, a temperature of from 900 to 1000 degrees F. is recommended for plain and low-alloy cast irons. Some of the higher alloy types can be more readily stress-relieved at temperatures up to 1150 degrees F. The usual rule is to heat one hour per inch of section and to cool very slowly to room temperature. This method should be effective in relieving the castings of all stresses.

When softening is desired in addition to stress relief, it is necessary to heat ordinary plain iron castings to about 1450 degrees F. and to hold them at this temperature for from one to one and one-half hours per inch of section, cooling very slowly to room temperature. For low-alloy cast irons, a temperature of from 1500 to 1550 degrees F. is required, and for the higher alloy irons, a still higher temperature must be used. The directions above apply especially in the case of Diesel engine pistons and engine heads.

High-Pressure Die-Casting Machines

DIE-CASTING machines of the type in which a cast-iron gooseneck is submerged in a melting pot filled with molten metal from which the die-castings are produced have been built for the last fifteen years by the Madison-Kipp Corporation, Madison, Wis. These machines are suitable for die-casting the so-called "low-temperature" alloys of zinc, lead, and tin, which can be cast at pressures of 500 pounds per square inch, and also for the production of aluminum-alloy die-castings. However, for die-casting alloys consisting of various combinations of aluminum, magnesium, and brass, pressures as great as 23,000 pounds per square inch may be necessary, and the equipment must be designed for metals having temperatures as high as 1800 degrees F.

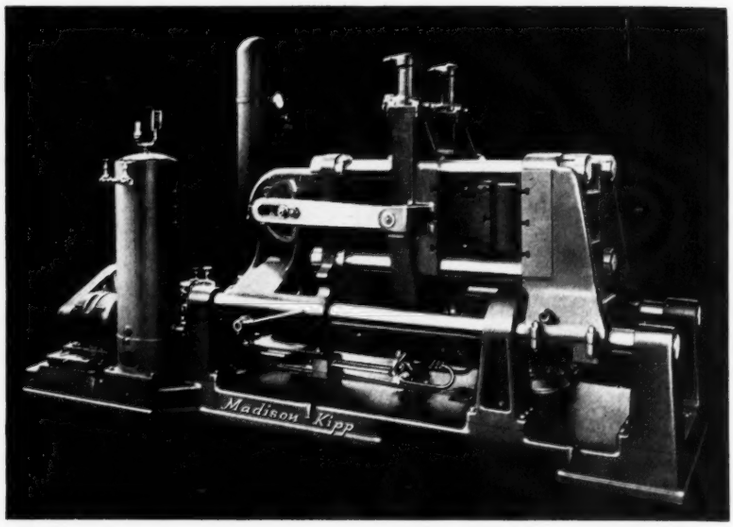


Fig. 1. Cold-chamber Type of Die-casting Machine Developed by the Madison-Kipp Corporation for the High-pressure Die-casting of Either High- or Low-temperature Alloys

To provide for the production of die-castings from various alloys of aluminum, magnesium, and brass, the Madison-Kipp Corporation has developed a 400 series of "cold chamber" type machines. These machines are built in three sizes. The smallest (No. 400) has a capacity for aluminum castings up to 0.9 pound, including the casting and gate, brass castings up to 1.5 pounds and magnesium castings up to 0.6 pound. In this machine, the total injection pressure on the metal is 19,000 pounds. The intermediate (No. 440) machine applies a total injection pressure on the metal of 38,000 pounds. The maximum weight of a casting and gate of aluminum that can be produced on this machine is 2 pounds, of magnesium 1.2 pounds, of zinc 5 pounds, and of brass 3 pounds. The total injection pressure applied by the largest (No. 404) machine is 63,000 pounds. The rated capacity of this machine for a casting and gate of aluminum is 3.25 pounds, of magnesium, 2.16 pounds, of zinc, 7.4 pounds, and of brass, from 2 to 4 1/2 pounds. All of these pressures and casting weights are

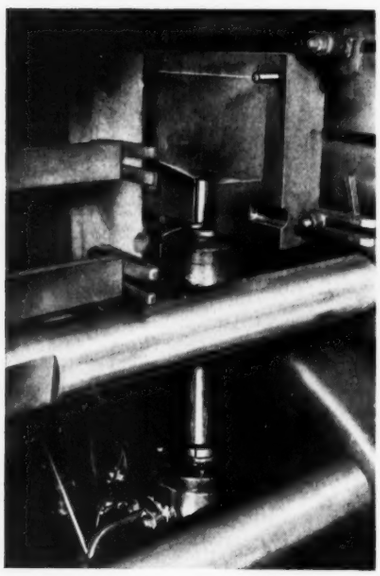


Fig. 2. The Metal to be Die-cast is Ladled Manually into a Well under the Bolster of the Fixed Die

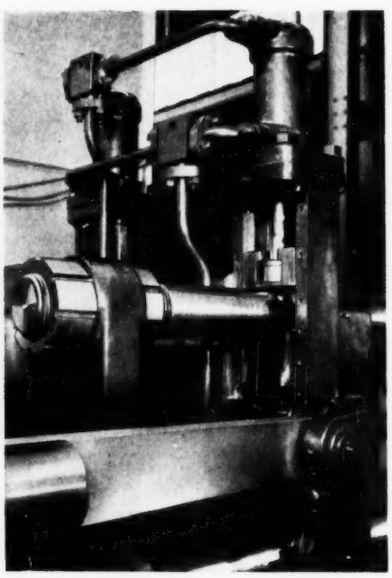


Fig. 3. Two of the Hydraulic Cylinders that Lock the Die Securely in the Closed Position

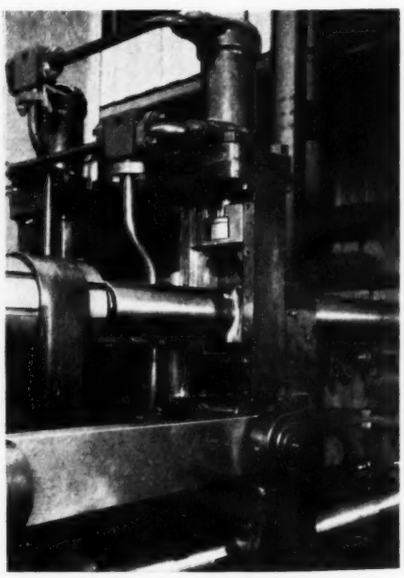


Fig. 4. The Same Two Locking Cylinders with the Pistons Raised to Lock the Wedges in the Tie-bars

for High-and Low-Temperature Alloys

based on certain machine standards; both pressures and casting weights may be varied to meet special requirements.

These new die-casting machines are designed to force molten metal into the die by hydraulic power, and they are provided with a powerful hydraulically operated locking mechanism for holding the die closed during the casting period without any strain being placed on the die moving mechanism. The molten metal is handled in such a way that there is no danger of contaminating the die-casting alloy with iron.

The new machines are equipped with the same type of dwell-cam crank mechanism as previous Madison-Kipp die-casting machines for accomplishing the closing and opening strokes of the die carriage and for inserting and withdrawing the die cores. A distinctive difference, however, is the use of a separate melting furnace and crucible from which successive "shots" of metal are ladled into a well under the die, which may be seen in Fig. 2.

The well and the hydraulic plunger for transferring the molten metal from the well into the die are located in a fixed position. Provision must therefore be made for locating directly over the well a cylindrical opening through which molten metal is forced into the die. This is accomplished by mounting the entire assembly of hot plate, movable die carriage, and die-operating mechanism on two guide rails so that this assembly can be slid into and out of the proper casting position. The fixed die member is also adjustable along the same guide rails for positioning over the well.

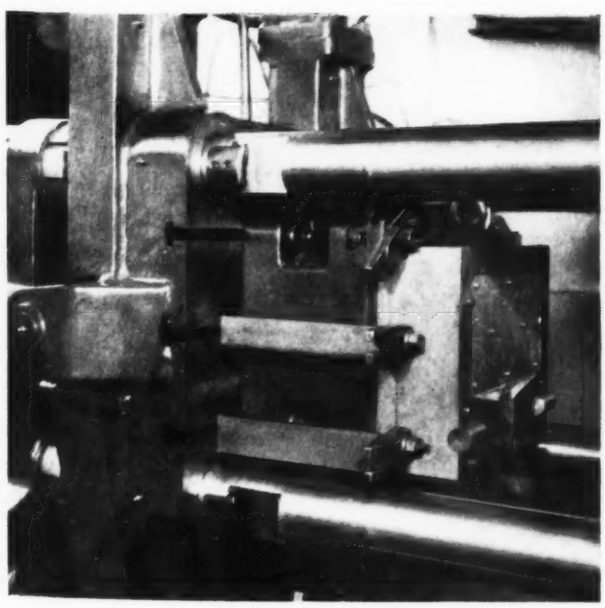


Fig. 5. The Assembly of Hot Plate, Movable Die Carriage, and Bolster, Shown in the Withdrawn Position

After the die closes, a valve is tripped for applying pressure to the fluid in a vertical hydraulic cylinder under the well. Connected to the piston in this cylinder is a vertical plunger which rises through the well and forces the molten metal up through the cylindrical passageway and into the die, applying a pressure up to 23,000 pounds per square inch in the die only, according to the requirements of the work.

With the closing of the die, four hydraulic cylinders, two of which may be seen in Figs. 3 and 4, force tapered wedges, at a pressure of 12,000 pounds each, into slots in four steel tie-bars, 4 1/2 inches in diameter. These hardened steel wedges engage hardened steel inserts in the tie-bars and at the back of the die carriage. The high pressure, in combination with a taper of only 5 degrees, insures absolute locking of the die carriage and of the movable die half against the fixed die member. Consequently, the high pressures employed for forcing the metal into the die cannot cause the die to open. The mechanism that actuates the forward and return movements of the die carriage is also relieved of all strain. A dwell on the cams that actuate the die movements permits the die to remain closed while the casting operation is taking place.

After a sufficient time has been allowed for the solidification of the casting, valves are automatically tripped to apply a pressure of 18,000 pounds through the four hydraulic cylinders, in order to withdraw the locking wedges from the four tie-bars. At this point, a rise on the cams of the cam crank mechanism causes the die carriage and the movable half of the die to withdraw to the starting position. During this return movement, the cores are withdrawn automatically, the finished casting is removed, and a new supply of molten metal is ladled into the well preparatory for the next cycle.

If required, the machine can be run continuously, with a finished casting removed and a new "shot" of metal ladled into the well during each cycle. Also, the operation can be interrupted by depressing a foot-treadle upon the completion of each cycle, in order to remove the finished casting and to replenish the metal in the well. At the left-hand end of the machine, as seen in Fig. 1, there is a prefill tank that contains the fluid for the hydraulic system. After each operating cycle, the exhaust fluid is returned to this tank. To the right of the prefill tank there is a high-pressure accumulator cylinder furnished with a pressure valve, and between the tank and cylinder there is a pump for building up pressure in the accumulator. This pump is of Madison-Kipp manufacture. It is of the plunger type for the largest machine, and of the conventional vane type for the medium- and small-sized machines.

Air-operated pilot valves open and close the hydraulic valves that admit fluid to the four locking cylinders for the die carriage and also to the cylinder that actuates the plunger for raising the molten metal into the die. The tripping of these valves is timed with the mechanism that actuates the movements of the die carriage.

* * *

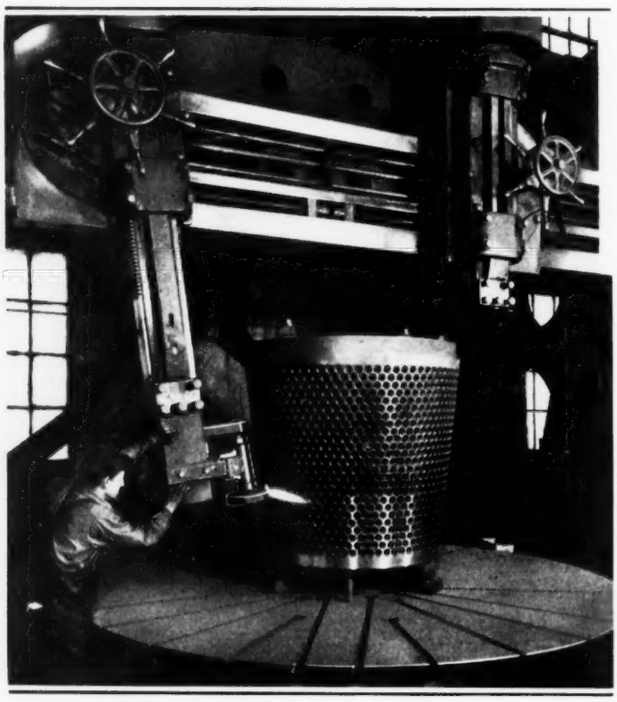
Unusual Job Shop Application of a Portable Precision Grinder

Several 43-inch cast-iron strainer cores of the type shown on the table of the vertical boring mill in the illustration recently had to be ground in the job shop of Love Bros., Aurora, Ill. A true taper and mirror-like finish were necessary. The operation was performed by mounting a Dumore No. 12 portable precision grinder on the lower end of one of the tool rams.

One of the difficulties of this operation was to overcome the wheel-dressing effect of the 1826 holes in the wall of the casting. The problem was solved through the selection of the correct type of wheel and the use of the proper wheel speeds and feeds.

* * *

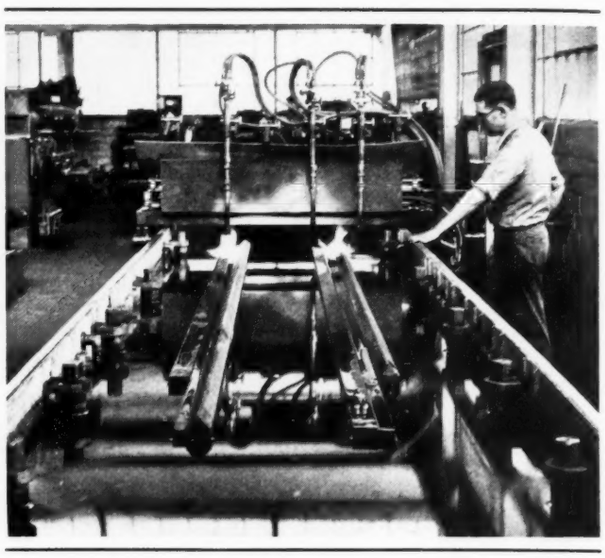
In 1936, Sweden imported metal-working machinery from the United States to a value of about $700,000; from Germany, to a value of $1,000,000; and from the United Kingdom, $375,000.



Using a Portable Precision Grinder on a Boring Mill to Finish a Large Tapered Casting with Over 1800 Holes

Flame-Hardening Lathe Beds

Various methods have been used to minimize wear on lathe beds, including the well-known chilling method, constructing the beds of welded steel, hard chromium-plating, and fastening hardened laminated steel strips on the bed to serve as wear-resisting ways. "Flame-hardening," however, is the latest method devised for producing hard wear-resisting ways for lathe beds. This method has been developed by the Monarch Machine Tool Co., Sidney, Ohio, after considerable experimentation.



Flame-hardening the Ways of a Lathe Bed to a Depth of 1/8 Inch

The illustration shows a 24-inch lathe bed, which is 25 inches wide over all and 14 feet long, immersed in the flame-hardening tank, the hardening being done after finish-planing. When the flame has traversed the entire vee and flat portions of the bed ways, they are hardened to a depth of 1/8 inch or more. Hardening to a depth of 1/4 inch can be accomplished by this process. Monarch lathes with flame-hardened beds are now available in all sizes and types, with bed lengths up to 14 feet. The hardened way surfaces of these beds are ground to a tolerance of 0.0005 inch in over-all length on large surface grinders. The hardened and ground surfaces have the appearance of hardened steel. The metal directly under the hardened sections is dense and close-grained and has an average hardness of from 220 to 230 Brinell. This close-grained metal gives a solid support to the hardened surfaces.

Casting strains are not imposed on the bed casting during the hardening process. The bed casting is kept at a normal temperature, except at the particular section of the surface being hardened. Repeated tests have shown no tendency of the hardened portions to crack or flake, even under abuse. Typical hardened bed sections have been repeatedly flexed under hydraulic pressure without injury to the hardened portions.

Motor Drives Discussed at the Westinghouse Machine Tool Forum

THE third annual Machine Tool Electrification Forum, held at the East Pittsburgh plant of the Westinghouse Electric & Mfg. Co., May 9 to 11, was attended by about ninety engineers and designers engaged in the machine tool industry and interested in the application of electrical equipment to machine tools. These engineers represented a total of fifty-five machine tool builders.

Four sessions were held, at which more than a dozen papers relating to machine tool electrification were presented, covering such subjects as recent motor standardization; the application of gear-motors to replace external speed reductions; planer drives; developments in multi-pole relays and manual starters; the trend toward combination line starters; improvements in punches, shears, and bending rolls, based on electrical developments; the use of graphic wattmeters in the building of machine tools; and the application of socket type instruments.

Variable-Voltage Drives for Planers

In a paper entitled "Planer Drives," by John E. Doran of the G. A. Gray Co., Cincinnati, Ohio, the gradual development of planer drives from the first planer up to the present time was traced. Mr. Doran pointed out that the requirements of an ideal planer drive are: (1) Smoothness; (2) accuracy of reversal; (3) high rate of acceleration and deceleration; (4) wide speed range; (5) good speed regulation; (6) reliability (low maintenance); (7) safety; (8) satisfactory speed torque characteristics; (9) good overload capacity; (10) not sensitive to supply voltage fluctuations; (11) accurate and convenient control; (12) minimum shop space; (13) must not have objectionable peak loads at the period of reversal; and (14) reasonable first cost.

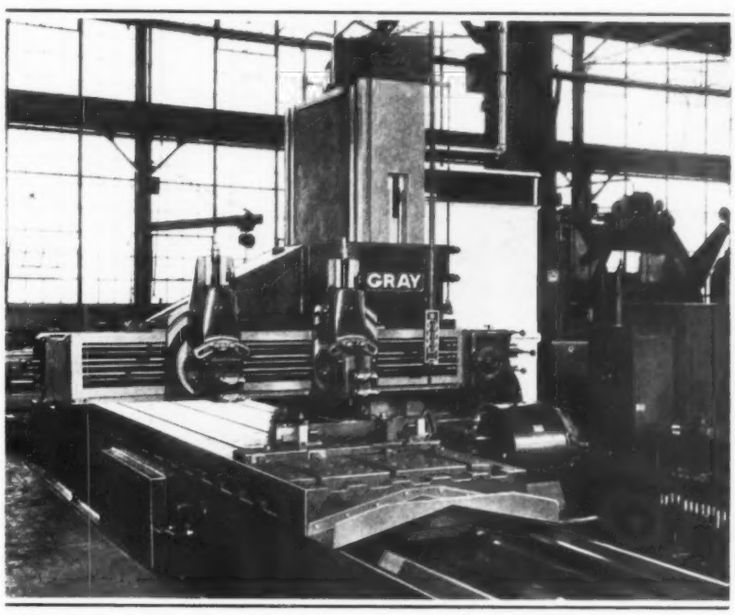
The paper was presented to show how the improved variable-voltage drive meets these requirements. It was pointed out that while such a drive will increase the total cost of a planer installation by about 10 per cent, an increase of from 15 to 20 per cent in production may be expected.

The accuracy of this statement was verified by an account made by C. W. Heppenstall, Jr., general manager of the Heppenstall Co., Pittsburgh, Pa., of an installation in his company's plant. A Gray planer with variable-voltage drive was installed in February, 1938. Another Gray planer of equally modern design, except that it had the conventional constant-voltage motor drive and control was installed in August, 1936. According to Mr. Heppenstall, the additional cost of the variable-voltage drive was approximately 10 per cent of the total cost of installation. He gave production figures on different classes of work, from which he drew the conclusion that for equivalent planer construction, a minimum increase in production of 15 per cent may be expected from the use of a variable-voltage drive.

Motor Drives and Electric Control for Punches and Shears

William C. Tucker, assistant chief engineer of the Machine Tool Division of the Buffalo Forge Co., Buffalo, N. Y., spoke on "Improvements in Punches, Shears, and Bending Rolls Based on Electrical Developments." In this paper, Mr. Tucker emphasized the fact that the efficiency of these types of machines has been greatly increased by the use of electrical equipment. "Electrical refinements," he said, "have been largely and directly responsible for the development of some of the oldest and most common types of machines from the 'ugly duckling' stage into the aristocracy of 'machine tools'."

Among the electrical refinements that have had



Planer with a Variable-voltage Drive, which, at an Increased Cost of Installation of 10 Per Cent, has Increased the Planer Output from 15 to 20 Per Cent

a particularly important bearing on the improvements made in the performance of punches, shears, and bending rolls were listed improved motors and motor characteristics, gear-motors, more positive and highly sensitized electrical controls, as well as the strides made in the field of electric welding, which have enabled a different type of frame construction to be used.

Electric Controls for Machine Tools

In a paper entitled "Build Electric Control as an Integral Part of the Machine," R. S. Elberty, electrical engineer of the Landis Tool Co., Waynesboro, Pa., emphasized the importance of making the electrical equipment an actual part of the machine tool design. He outlined the practice of his own company in applying electric control to cylindrical grinding machines. This practice comprises the following points:

1. All equipment meets N.E.M.A. standards for 600 volts.
2. Overload and low-voltage protection are provided for all motors, either through a protective contactor or by direct magnetic control.
3. The "disconnect" switch is interlocked with the cabinet door handle, so that all power is shut off when the door is opened.
4. The mounting of the electrical equipment and the location of the machine wiring are completely shown on an electrical assembly drawing.
5. The wiring diagram shows all the accessories, as well as the magnetic panel wiring. A schematic diagram is also included for the more complex circuits.
6. Machine wiring uses lead cable for wires within the machine, single solid conductor Thiokol wire for conduit runs on the outside of the machine, and Duprene multi-conductor stranded cable for all flexible connections. No rubber-covered wire is used for machine wiring.
7. All wiring connections are made in junction boxes.
8. Where electrical accessories are likely to be subjected to splashing water or oil, they are protected by suitable enclosures.

Suggestions to Makers of Electrical Accessories

In referring to electrical accessories, Mr. Elberty referred to the practice of his own company, rather than to that of the entire machine tool industry, since there is no uniformity of practice. "All accessories," he said, "should meet the N.E.M.A. standards for 600 volts; compactness in size, while not an essential feature, is a considerable asset." He said that his company would like to see the electrical manufacturers develop the following apparatus for machine tool electric drives:

1. Push-buttons. Flange-mounted and waterproof from the outside of the flange. Momentary and maintained contact with large-diameter (1 1/2-inch) buttons. Rating, 10 amperes.
2. Selector Switches. Flange-mounted and waterproof from the outside of the flange. Up to five positions, maintained contact or spring-centered. Rating, 10 amperes.
3. Alternating-current Magnetic Timing Relay. Low cost (dashpot type). Maximum time, 8 to 10 seconds. Remote adjustment of time, if possible. Rating, 10 amperes.
4. Slow Make-and-break Limit Switch. Waterproof, flexible, small size. Rating, 10 amperes.
5. Snap-action Limit Switch. Accurate action; long life; make-and-break contacts, maintained or spring-return; waterproof; with butterfly cam motion. Rating, 10 amperes.
6. Measuring Switch. Mechanical drive, adjustable, resetting position switch. Low cost, small, waterproof, range 100:1, make-and-break contacts. Rating, 10 amperes.
7. Circuit-breakers. Flange-mounted, waterproof from front of flange, two- and three-pole. Ratings up to 100 amperes.

Referring again to the neat appearance and small size of electrical accessories, Mr. Elberty emphasized that reliability is more important than small size and low cost, although electrical control of machine tools will not reach its full possibilities unless the cost can be kept down. In closing, he made this statement: "Machine tools should be electrified while still on the drawing-board. Many objectionable features of electrified machine tools are due to the fact that the last and least consideration in the design of these machines was the electrical equipment. Forethought in the application of electrical equipment while the machine is still in the design stage will pay big dividends in reduced costs, better performance, and improved appearance of the completed machine."

A User's View of Motor Applications

In a paper prepared by W. S. Risser of the Works Equipment Department of the Westinghouse Electric & Mfg. Co., the machine tool user's viewpoint was emphasized by an engineer whose duties are concerned with the maintenance of equipment. On this subject, Mr. Risser said: "From the user's standpoint, it is very desirable in applying motors to machines to mount them so that they will be accessible for inspection and maintenance. While the present-day motor is built to withstand a lot of hard work and even abuse, it should be inspected occasionally, and, for this reason, should be mounted so that this can be done. We have had cases where motors and control were so mounted that it was extremely difficult to get at them when trouble occurred. This does not mean that the motor should not be installed as an integral part of the machine, but the design should be such that, if necessary, the motor can be removed without an excessive loss of time and labor.

"On applications where the motor is not enclosed in the base of the machine and where it is mounted near the cutting tool, consideration should be given to having the motor totally enclosed, in order to

prevent dirt, chips, and moisture from getting into the windings. On several machines used for machining cast-iron parts, the motors were mounted on top of the headstock, near the spindle. Standard open motors were used first, but the cast-iron dust got into the windings and caused so much trouble that it was necessary to change to totally enclosed fan-cooled motors. Since that time, we have had no more trouble from this source.

Suggestions for Machine Tool Builders on the Selection of Motors

"It might be well for the machine tool builder to question the type of work to be done by the prospective customer in order to determine the best motor application for a particular job. We find in some departments that it is necessary to use enclosed explosion-proof motors, due to the possibility of dust explosions. In our foundries, totally enclosed fan-cooled motors are used extensively where the dust hazard is pronounced.

"If the user of machine tools has direct current available, it is often advantageous to use adjustable-speed direct-current motors for driving machines in place of constant-speed alternating-current motors. In some cases, the design of the machine can be simplified and better operation obtained because of the greater flexibility of speed control and the closer adjustment of speed obtainable.

"The proper selection of control is as important as the selection of the motor, from the standpoint of the user of machine tools. If the control is built into the machine, it should be as accessible as the motor. This control should be as rugged as possible, with as large a current-carrying capacity as is consistent with the space available for internal mounting.

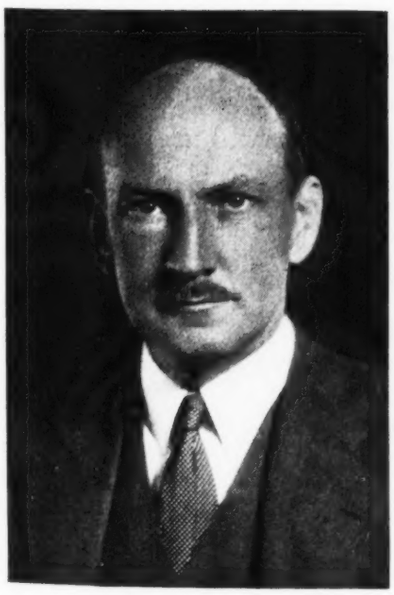
"Our practice at East Pittsburgh has been to mount all electrical equipment on the machine, as far as possible, in order to make it a self-contained unit. In a plant of this size, we do considerable moving of machines from time to time, in order to improve our lay-out to suit changing manufacturing conditions. If all electrical equipment is mounted on the machine, it is much easier and cheaper to move it from one location to another.

"The wiring of machine tools has been given serious consideration by the builders and users of machine tools. All of our wiring is put in conduit, either solid or flexible, and stranded wire is used, as solid wire may break due to vibration. Loose wires on the inside of a machine may cause a great deal of trouble and lost time, due to shorts or grounds."

* * *

The Czechoslovakian machinery industry operated at a record level in 1937. This activity has continued well into 1938. The exports of machinery from that country increased nearly 50 per cent in 1937, compared with 1936.

New Officers of the Gear Manufacturers' Association



Howard Dingle, Cleveland Worm & Gear Co., New President of the Association

Charles F. Goedke, Ganschow Gear Co., Vice-president of the Association

J. Harper Jackson, Jackson Gear Co., Treasurer of the Association

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Sheet-Metal Blanking, Forming, and Drawing Dies—Fifth of a Series of Articles

By CHARLES R. CORY*

THE previous articles in this series have dealt with blanking dies that simply blank without performing any other operation. The present article will deal with blanking and piercing dies of the compound type. At every stroke of the press, the blank is sheared out of the stock simultaneously with the piercing of holes in the blank. In the compound type of blanking and piercing die the action of blanking and piercing occurs in one stage, or at one feeding position. In the blanking and piercing die of the progressive type, the blanking and piercing operations take place in two separate stages. However, in either a compound or a progressive type of die, one finished part is produced at each stroke of the press.

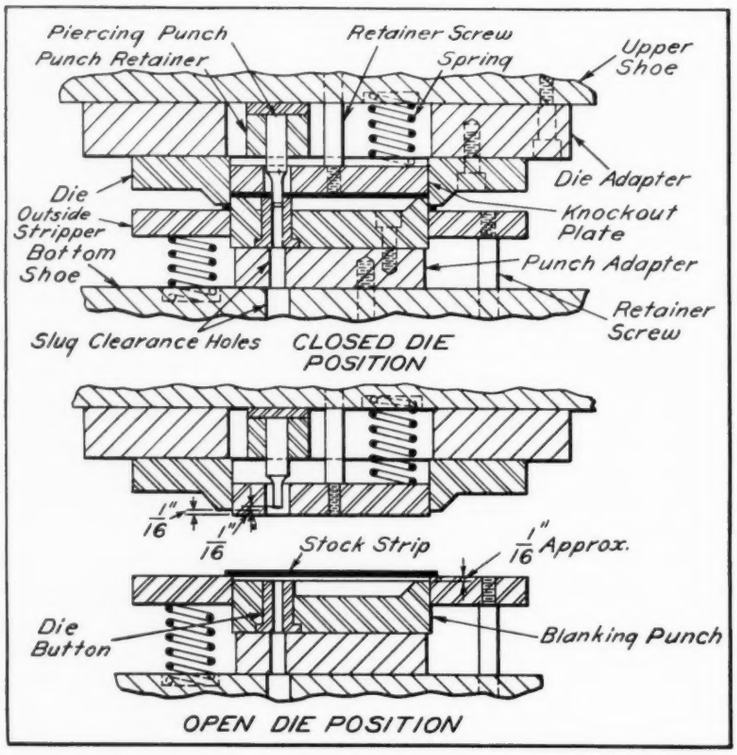


Fig. 1. General Arrangement of a Compound Type of Blanking and Piercing Die

The compound type of blanking and piercing die resembles a return type blanking die except that piercing punches are added. In the progressive type of die, the blanking part of the die resembles a drop-through type blanking die, since the piercing punches and dies are provided in a preceding stage of the cycle.

In the compound type of die, the blanking operation is performed by a punch and die mounted in the same manner as in a return blanking die. The punch is attached to the lower shoe and the die to the upper shoe. The stock strip is supported by a spring- or air-operated outside stripper which surrounds the punch. On the down stroke of the press, the die comes in contact with the stock strip lying on top of the outside stripper. The continued down travel forces the outside stripper down around the punch, thereby shearing the blank from the stock strip. On the up stroke of the press, the outside stripper keeps the stock strip in contact with the die until it is stripped off the punch.

Piercing punches are mounted in the upper shoe, inside the die opening. The bottom or cutting surfaces of the punches are at a somewhat higher level than the cutting surfaces of the die itself, so that the blank is sheared before it is pierced. As the blank is sheared from the stock strip and forced up into the die opening, the piercing punches pierce holes in the blank. The metal slugs pierced out of the blank are forced down through holes in the blanking punch by the piercing punches. There is a knock-out or inside stripper plate inside the die opening. This knock-out ejects the blank from the die opening and from around the piercing punches.

The operation of piercing is, in theory, the same as that of blanking. The piercing punch passes into a hole in the blanking punch. This hole is larger than the piercing punch by an amount that will allow a side clearance between them equal to 10 per cent of the stock thickness, on a side. The arrangement of a piercing punch in a die of this type is indicated in Fig. 1.

The punch unit of a blanking and piercing die consists of the blanking punch, together with die buttons into which the piercing punches enter. (See Fig. 1.) Separate die-button retainer plates are

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employed if the blank is large enough to permit their use. Die buttons are not always used, since frequently the die holes through which the piercing punches force the slugs are drilled directly in the punch itself.

When die buttons are used, they consist of hardened steel bushings. The die button is pressed into the punch or into the retainer plate. It has a head or shoulder which prevents it from being pulled out by the stripping action of the piercing punch on the up stroke of the press.

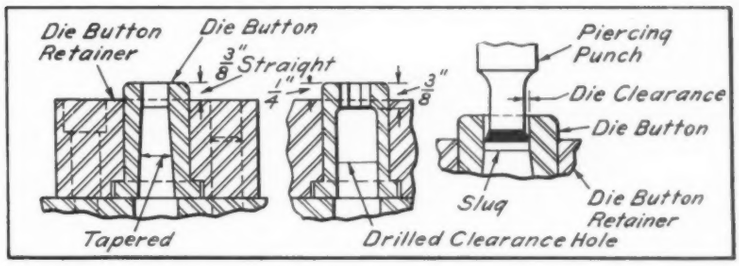


Fig. 2. Design of Die Buttons

Die buttons are used if the die is intended for fairly high production and if there is room for them. If the pierced hole is to come close to the edge of the blank, the die button is pressed into the punch section itself, but when there is room, a retainer plate made from a separate piece of soft steel is usually employed.

The cost of die construction is less if the die hole for piercing is directly in the punch or in a separate hardened steel block, rather than in a die button. Die buttons are used, however, for large production, on account of the greater ease of replacement when necessitated by wear or breakage at the cutting edge.

A die button for a circular or rectangular hole can be replaced in the punch or retainer plate without difficulty in locating it to suit the location of the piercing punch; but a die button for an irregular-shaped hole is not easily replaced. A duplicate is difficult to make so that the die hole is in exactly the same relation to the outside of the die button as it was in the original die button.

If the piercing die holes are in a solid block of steel or directly in the punch section, rather than in a die button, replacement is more difficult. The dowel- and screw-holes in the new block or punch must be lined up with those already in the adapter, or else new ones must be drilled in the latter. In many cases, there is not room for duplication of the dowel- and screw-holes.

Obviously, die buttons cannot be used if the hole to be pierced is too close to the blank edge; nor are die buttons usually employed for holes over 1 inch in diameter. Breakage of the cutting edge, necessitating replacement, is less common in the case of holes of that size.

The hole in the die button is usually of uniform diameter (straight) for a distance of 3/8 inch down from the top surface, as shown to the left in Fig. 2. Below that, there is side relief to free the slugs when they have been pushed down that far. This relief is produced by taper-reaming from the bottom, if the pierced hole is round. If the hole is not round, a large round hole may be drilled from the bottom to 3/8 inch of the top surface to provide relief. (See center view, Fig. 2.) If the irregular hole is large, this relief may be end-milled.

The slugs sheared from the blank will be the size of the piercing punch on the top side and the size of the die hole on the bottom side. In other words, the slugs will have tapered sides, the size of the bottom surface being equal to that of the top surface plus the die clearance. (See right-hand view, Fig. 2.) The side of the blank in contact with the die button will have a burr on the edge of the pierced hole, and the side in contact with the piercing punch will have a round edge. The duller the punch and die edges, the greater the burr.

If the shape of the pierced hole is not round, it is necessary to prevent the die button from turning, in spite of the fact that it is a press fit in the retainer. The usual method is to machine a flat on one side of the head of the die button extending down to the body of the button. A slot is milled in the bottom surface of the retainer, equal in depth to the thickness of the die-button head. (See the left-hand view, Fig. 3.) One side of the retainer slot fits the flattened side of the die-button head; the other side clears the side of the button head opposite the flatted side. This prevents the die button from turning.

Another method of preventing the die button from turning is to drill a hole vertically from the bottom with half of the hole in the retainer block and half in the die-button head. A locking pin is pressed into this hole, as shown in the center view, Fig. 3.

Still another method is to drill and tap a hole sidewise through the die-button retainer and drill a cone point in the die button. A cone-pointed set-screw is then used to prevent the button from turning. (See right-hand view, Fig. 3.) However, this method is often inconvenient because of lack of space.

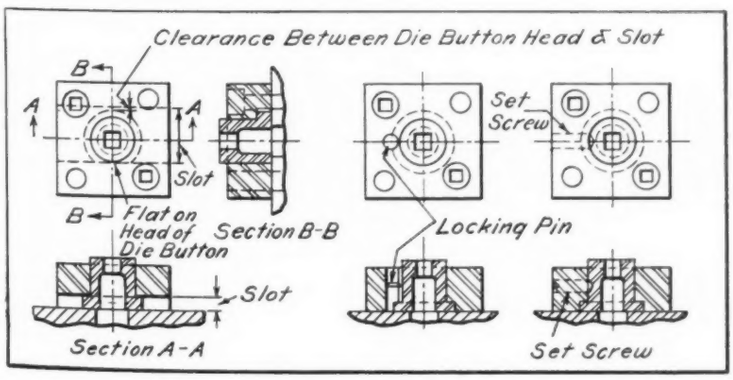


Fig. 3. Methods Used for Preventing Die Buttons from Turning

Die-Button Retainers

There is an advantage in pressing the die buttons into retainers rather than into the punch itself. A change in the blank size or in the pierced hole size or location does not then affect the blanking punch sections. In case a blanking punch section has to be replaced, due to chipping of the cutting edge, the section replaced is cheaper, since it would not include the piercing die holes. A die-button retainer is made of soft steel. Its top surface is about 1/4 inch below the top surface of the die button to allow for grinding the top surface of the die button when sharpening the cutting edge.

The blanking punch sections and die-button retainers are usually fastened to an adapter if more than one punch section is required. The punch adapter is similar to that used in a blanking die. It is machined so as to dispose of the slugs from the pierced holes. The slugs may be disposed of by "shedding"; by being dropped through the bolster plate; or by being dropped through the bottom shoe into a slug channel.

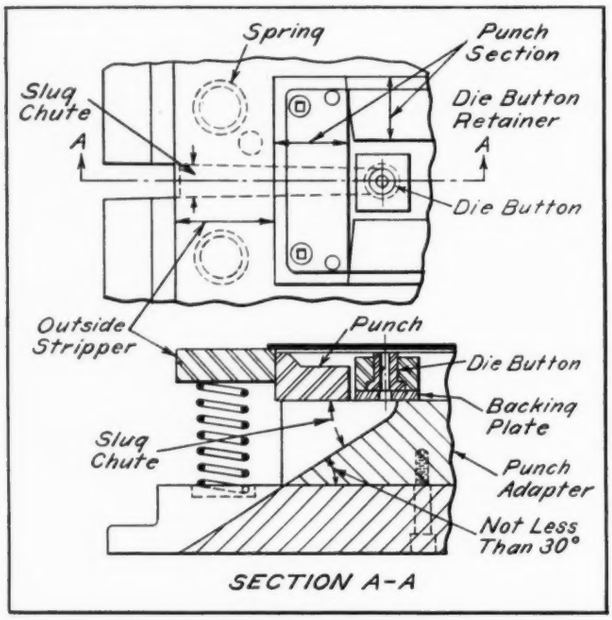


Fig. 4. Slug Chute for Shedding Slugs from Pierced Holes

In the first method, the slugs drop through the die hole in the die button or punch section and strike the radial surface of a slug chute machined in the adapter. As shown in Fig. 4, they are then shed sidewise along this chute to a part of the bottom shoe or bolster plate that is accessible. The angle of inclination of the slug chute should not be less than 30 degrees to insure that the slugs will slide away without jamming. As shown in the plan view, the chute should taper to obtain an increasing width and prevent jamming as the slugs slide downward. If it is inconvenient to remove the slugs from the die-shoe at the edge of the adapter, the slug chute may be continued through the die-shoe to the outside edge. The slugs will then fall on top of the bolster plate.

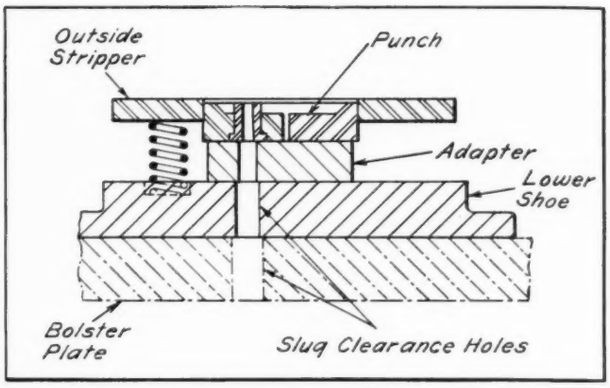


Fig. 5. Shedding Slugs through Holes in Adapter, Shoe, and Bolster Plate

Slugs Dropping through Bolster Plate

The slugs can also be disposed of by dropping successively through clearance holes in the adapter, shoe, and bolster plate, as shown in Fig. 5. This is the cheapest method of slug disposal, provided the bolster plate has a hole in it. If it is necessary to drill special holes in the bolster plate, this method may be objectionable, because of the damage done to the plate; nor is the method suitable in the case of a press that is equipped with an air cushion plate, since the slugs would fall on top of this plate.

Slugs Dropped into a Slug Channel

The slugs can also be made to drop through clearance holes in the adapter and lower shoe into a slug channel, which is cored in the bottom surface of the lower shoe, as indicated in Fig. 6. This channel extends either from the front to the rear or from the

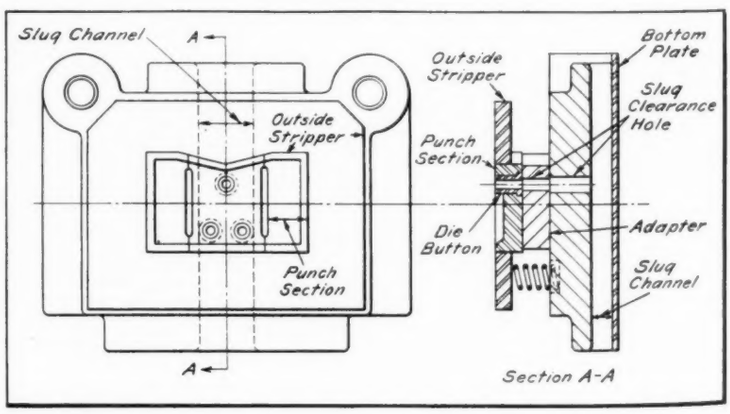


Fig. 6. Using a Slug Channel Cored in the Bottom Surface of the Lower Shoe for Shedding Slugs

right to the left of the lower shoe, depending on which is most convenient to the operator when pushing out the slugs. The channel should be from 1 to 2 inches in height. If the die is to be used in a large press with air pin-holes in the bolster plate, the slugs may fall through these holes unless a plate is fastened to the lower shoe to act as a bottom for the slug channel. This bottom plate is necessary only if the slugs are smaller than the air pin-holes in the bolster plate.

The die buttons are often seated against soft steel backing plates if the slugs are to be shed sidewise. The reason for this is that a slug chute which is milled in the adapter takes away much of the bottom bearing area of the die button; the backing plate restores this bearing. The use of the backing plate is more important when thick stock is to be pierced, since the piercing pressure is greater. These backing plates, as indicated in Fig. 7, are usually as large in area as the punch section or retainer into which the die button is pressed. They could, however, be round disks inserted in counterbored holes in the adapter, as shown to the right in Fig. 7. With the disk type, the diameter of the disk, of course, should be as much greater than that of the die-button head as possible.

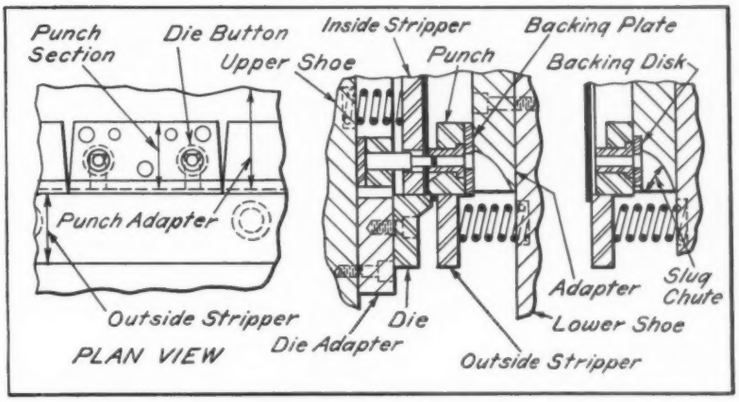


Fig. 7. Arrangement of Die-button Backing Plates

The next installment of this series of articles will deal with the construction of the upper member or blanking die proper, and with other details of compound blanking and piercing dies.

Machine Shop Practice Meeting in Rochester

THE Machine Shop Practice Division of the American Society of Mechanical Engineers held a three-day meeting in Rochester, N. Y., May 10 to 12, with headquarters at the Sagamore Hotel. The meeting was sponsored by the Rochester Section of the Society, in cooperation with the American Foundrymen's Association. There were five sessions dealing with the following subjects: Gears and machine tools; inspection procedure; foundry metals; apprentice training; and shop practice and drafting.

The following papers were presented before the meeting: "A New Method of Producing Machine Screw Products," by E. W. Brinkman, Davenport Machine Tool Co., Rochester, N. Y.; "Industrial Applications of Spiral Bevel and Hypoid Gears," by Allan H. Candee, mechanical engineer, Gleason Works, Rochester, N. Y.; "Inspection Procedure," by Carl L. Bausch, Bausch & Lomb Optical Co., Rochester, N. Y.; "Engineering Approach to the Use of Steel Castings," by F. A. Lorenz, Jr., vice-president, American Steel Foundries, Chicago, Ill.; "Developments in the Engineering Possibilities of Gray Iron Castings," by A. C. Denison, president, Fulton Foundry & Machine Co., Cleveland, Ohio; "Malleable Iron Castings for Engineering and Miscellaneous Uses," by Enrique Touceda and J. H. Lansing, consultant and shop practice engineer, respectively, Malleable Founders' Society, Cleveland, Ohio; "Apprentice Training," by George B. Heddendorf, International Business Machines Corporation, Endicott, N. Y.; "Trends in Shop Practice and Drafting," by William L. Bond, General Electric Co., Schenectady, N. Y.; and "What's New in Electrical Equipment for Manufacturing Operation," by W. D. Turnbull, manager of machinery electrification section, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

* * *

Motion Picture Shows Making of Ludlum Stainless Steels

The manufacture and uses of Silcrome stainless steels are depicted in a natural-color motion picture that was recently shown at a preview held at the New York Museum of Science and Industry, New York City. This film shows the melting, pouring, rolling, and drawing of stainless steels in a striking manner. Especially spectacular is the melting of high quality steels by means of the electric arc.

The production of bars, strip stock, wire, and Ludlite are shown in considerable detail. During the complete showing of the film, the manufacturing operations and applications of the various steels were explained by a metallurgist in an interesting and instructive manner.

This film will be made available for presentation before technical and non-technical organizations. Applications for a showing should be made to the Ludlum Steel Co., Watervliet, N. Y.

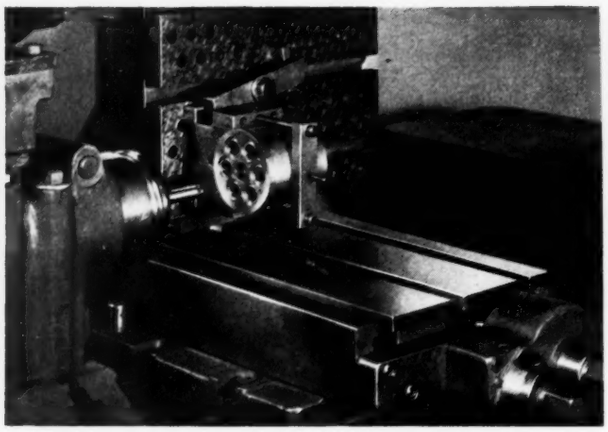


Fig. 1. Precision-boring of Small-lot Work on Ex-Cell-O Machines has been Facilitated by the Development of a Universal Indexing Fixture

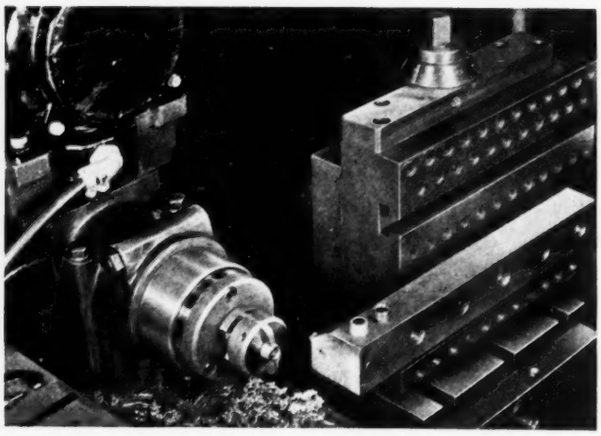


Fig. 2. Operation in which the Work is Mounted on the Spindle of the Precision Boring Machine, and the Tool-bar on the Universal Fixture

Precision-Boring Applied to Small-Lot Work

PRECISION boring, turning, and facing operations are usually associated with mass production, but there has been considerable extension of these operations into the field of low-quantity production. Two major factors have led to this development; first, the introduction of precision machines having a high degree of flexibility; and second, the designing of universal fixtures which still further increase the flexibility of the machines.

Various operations on precision boring machines built by the Ex-Cell-O Corporation, Detroit, Mich., involving the use of a universal indexing fixture are shown in the accompanying illustrations. This universal fixture facilitates the handling of a wide variety of work. The fixture has three T-slots and six staggered rows of 1/2-inch tapped holes in it. The holes are spaced 1 inch apart and facilitate the mounting of work, tool-bars, or sub-fixtures.

With this universal fixture on a precision boring machine, the work can be mounted on the fixture and the boring tool on the spindle or vice versa. The upper portion of the fixture is so designed that it can be mounted on the cross-slide of the machine, either at right angles to the spindle or parallel with the spindle. Alignment keys provide for accurate set-up in either manner. The cross-slide is equipped with a ground lead-screw, and the normally hand-

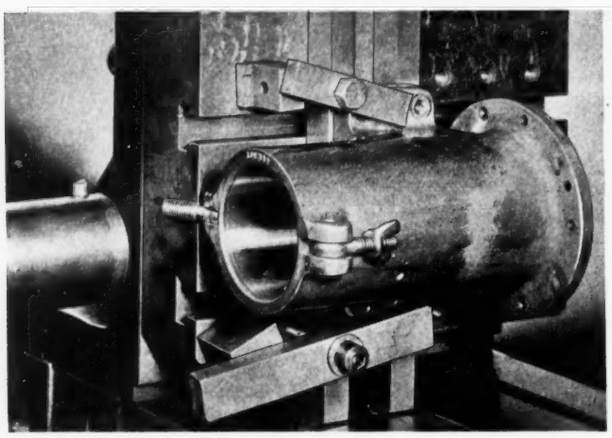


Fig. 3. Precision Boring a Cylinder 3 1/4 Inches Diameter by 8 Inches Long within 0.0001 Inch

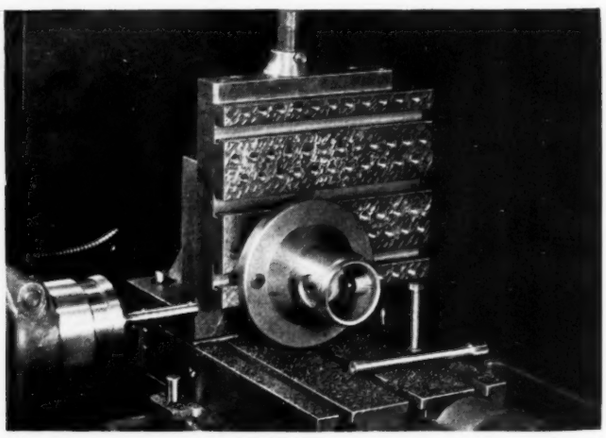


Fig. 4. Finishing the Wrist-pin Holes in a Semi-steel Piston Required in Limited Quantities Only

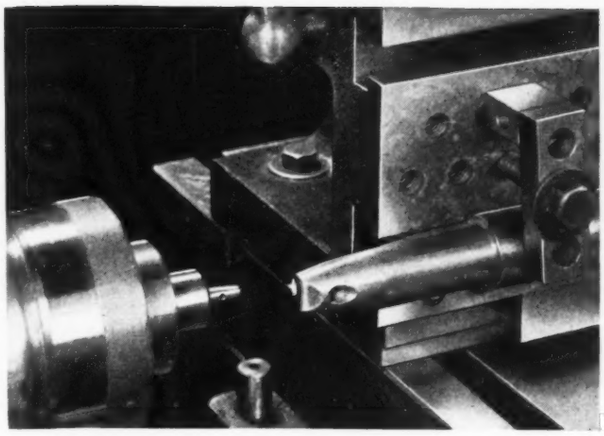


Fig. 5. Precision Taper-turning Operation, in which the Tool is Mounted on the Universal Fixture, and the Work in the Machine Spindle

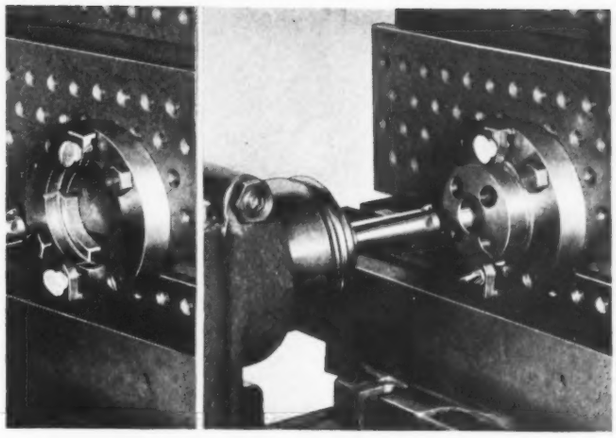


Fig. 6. The Use of a Simple Indexing Fixture Mounted on the Universal Fixture Facilitates the Finish-boring of Five Holes in a Part

fed fixture can readily be furnished with a hydraulic cross-feed cylinder if desired.

Fig. 1 shows a single-spindle precision boring machine equipped with tungsten-carbide tools being used for finish-boring the stator body of a Diesel injector. This part is put through the shop in lots of fifty. Six holes around the center of the part must be finished to the specified dimension within plus or minus 0.0002 inch, from 0.008 to 0.010 inch of stock on the diameter being removed.

In setting up for this operation, one of the holes is aligned with the spindle, and an adjustable stop and plug gage are used for indexing the remaining five holes after each one is finished. If production runs should be increased or a higher output per hour desired, a simple indexing fixture could be added to the universal fixture.

The same type of machine and fixture are shown in Fig. 2 being applied for facing and inside-chamfering an airplane-engine valve key. In this case, the tool-bar is mounted on the universal fixture, while the work is held in the machine spindle by a simple centrifugal chuck. This chuck has two fingers which engage a tapered surface on the part as the spindle rotates and hold the part against the faceplate.

The tool is of a combination type. It is brought up to position and fed in rapidly to face the end of the key. At the end of this travel, the tool is fed outward gradually to chamfer the part internally. For increased or continuous production, a hydraulic cylinder could be added to this machine to control the transverse fixture movement. The tool-bar in this set-up is also of a universal type adaptable to a wide selection of tools.

The finishing of the cylinder of a machine used for metering fluids is facilitated by the use of a similar machine and universal fixture, as shown in Fig. 3. Although this part is produced in very small lots, the flexibility of the equipment permits the job to be done economically. The dimensions of this part, which has a bore 3 1/4 inches in diameter by 8 inches long, are held within 0.0001 inch. The material is a high nickel alloy, and a diamond tool is used for the boring operation.

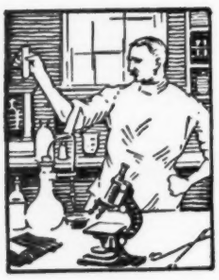
The machining of pistons is generally a mass production operation, but Fig. 4 shows an operation on a semi-steel piston that is required in limited quantities only. This operation consists of boring the wrist-pin holes. An adjustable stop and a plug gage, similar to those referred to in describing the operation illustrated in Fig. 1, may be seen in the illustration. By means of the stop and plug gage, the wrist-pin holes are readily aligned with the boring-bar. Tolerances are held to 0.0002 inch in this operation, which is typical of many production requirements in small shops.

The same type of equipment is shown being used in Fig. 5 for the precision taper-turning of a valve part that is required in lots of from 100 to 200. The boring-bar, with its tungsten-carbide tool, is mounted on the universal fixture, and the part is held against a faceplate on a standard spindle by the use of a special adapter. The spindle is positioned at an angle to obtain the correct taper. The precision-turning of this part makes it sufficiently smooth and accurate to hold a 5-pound pressure when the part is assembled in the valve, so that lapping is unnecessary.

When production runs are repeated frequently, the provision of an inexpensive sub-fixture for mounting on the universal fixture may simplify the manufacturing problem. Fig. 6 shows such a sub-fixture being used for boring five holes in an iron casting. The part is located from its diameter, the sub-fixture being designed to permit boring completely through the part, although it is mounted against the fixture face. All holes are conveniently bored, because the indexing sub-fixture enables the various holes to be located rapidly.

The universal fixture with its adjustable vertical and horizontal cross-slides and rapid indexing attachment can also be used on two-spindle precision boring machines. Such an application is particularly suitable for installations when a part must be rough-machined before the finishing operations.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

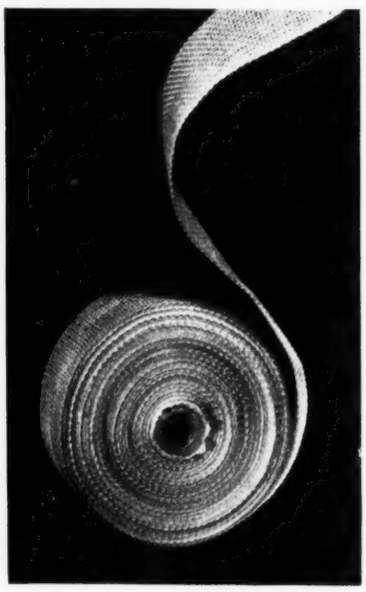
Molding Compound for Parts Requiring Large Inserts

A molding compound known as 2274 has been announced by General Plastics Inc., North Tonawanda, N. Y., for use in molding parts that have especially large metal inserts and that are subject to extremes of temperature. While this material is comparable to standard compounds, the final set is slightly more flexible. Thus cracking of the finished piece, due to expansion and contraction of the inserts, is avoided. The compound is especially adapted for molding terminal studs, brush-holders, and so on. 201

Electric Insulating Tape Made from Glass

Electric insulating tape woven entirely from glass yarns has recently been developed by the Corning Glass Works, Corning, N. Y. This tape, with the appearance and flexibility of ordinary cotton or silk tape, is intended for the insulation of coils for motors, generators, and transformers, and for cables and other electrical conductors. It is made entirely from glass, and not only has exceptional electrical properties and chemical resistance, but also withstands temperatures far in excess of the limits specified for Class B high-temperature insulation.

The tape can be readily impregnated with resins, gums, and varnishes to form an insulation impervious to moisture and having high dielectric strength. The flexibility of this tape is due to the extreme fineness of the glass fibers, which are from 1/15 to 1/20 the diameter of a human hair. Coils insulated with this tape have been installed in street cars, electric locomotives, etc. 202



Electric Insulating Tape Made from Glass

Neoprene-Lined Hose in Machine Tool Hydraulic Lines

Hose lined with Neoprene, the synthetic rubber produced by E. I. du Pont de Nemours & Co., Wilmington, Del., has proved satisfactory for conveying oil under pressure in the hydraulic systems of oil-actuated machine tools. An important requirement in such applications is the ability of the hose to withstand mechanical action, as well as the chemical effects of the oil. 203

A New Coating for Protecting Finished Surfaces

Highly polished, painted, plated, or duco-finished surfaces can be protected from scratches, tarnish, etc., by a liquid known as "Protex," which has been developed by the Haydn F. White Co., Cleveland, Ohio. This liquid is brushed or sprayed on the surface to be protected, which should then be covered, preferably with so-called Kraft paper. The liquid quickly sets to a moisture-proof, tough skin that is opaque and a good insulator for low-voltage electric current. When the protective covering is no longer needed, the skin that it forms readily peels off with the Kraft paper—or if paper is not used, it can easily be pulled off by itself. The metal is then left in its original polished condition.

When sprayed or brushed on parts or assembled machines in storage, rust or corrosion is prevented. It is also a suitable coating for equipment in a plant that is not to be used for some time. It is further stated that Protex-protected sheet metal can be stamped or pierced without removing the coating. In that case, however, the dies should have extra clearance to take care of the coating. 204

To obtain additional information about materials described on this page, see lower part of page 708.

Stainless Steel Expected to Protect Records for 6000 Years

Stainless steel is being used extensively in the construction of a subterranean vault at Oglethorpe University, Atlanta, Ga., in which it is planned to seal a record of our civilization for sixty centuries. Stainless-steel urns filled with an inert gas will be used for the perishable materials, which will be placed on stainless-steel shelves. To save space, many books, photographs, and motion pictures will be reproduced on a micro-film, which has a nickel base, the image on it being in platinum. The films will be placed in glass tubes filled with an inert gas and sealed in asbestos containers. The glass containers will be sealed in stainless steel.

A stainless-steel door, measuring 50 by 114 inches, has been designed for the vault by Craig M. Bollman, art director of the American Rolling Mill Co. The placque that will tell succeeding generations about the contents of the crypt and its purpose is also of stainless steel. Behind the door will be a projection machine of stainless steel with gold-plated ball bearings. 205

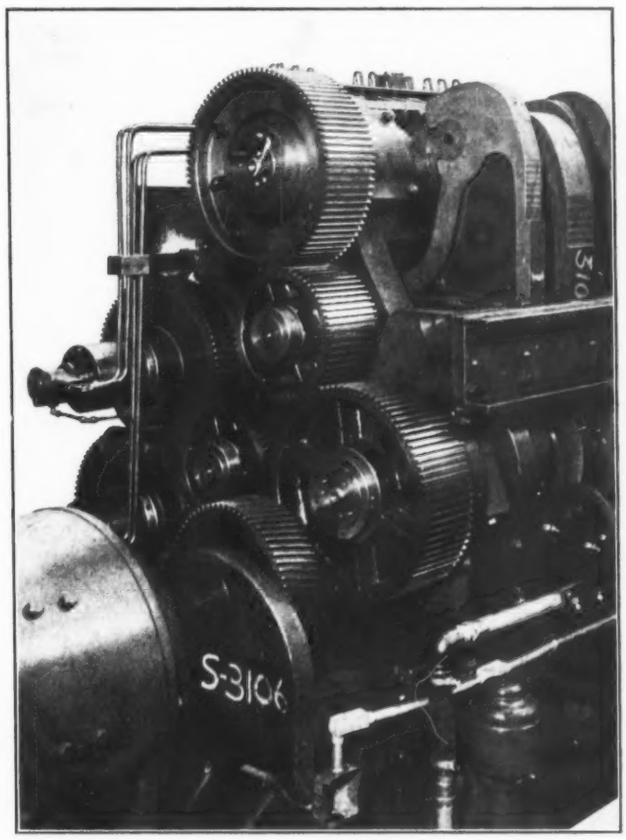
Molybdenum Iron Castings in Machine Tool Construction

Various properties inherent in molybdenum iron castings adapt them to a wide range of applications. According to the Climax Molybdenum Co., New York City, a chromium-molybdenum iron is being used for all main drive and intermediate gears and for tool-carriers in the construction of automatic crankshaft lathes built by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. The illustration shows these gears, as well as the tool-carriers at the right of the gear train. A plain molybdenum iron is used for hydraulic chuck manifolds.

The gears range from 15 to 22 1/2 inches outside diameter, and the face width is 1 1/2 inches for all sizes. The iron used for the gears and tool-carriers is of the following analysis: Carbon, 3.10 to 3.25 per cent; manganese, 0.70 to 0.95 per cent; silicon, 1.75 to 1.90 per cent; sulphur, approximately 0.08 per cent; phosphorus, 0.15 per cent; chromium, 0.20 to 0.30 per cent; and molybdenum, 0.30 to 0.35 per cent. Tests on a specimen taken from the middle of a 3 1/2-inch gear section have shown a tensile strength of 35,600 pounds per square inch and a Brinell hardness of 207. The castings for the gears are blanks on which teeth are hobbed by the machine tool builder. The castings are produced by the Stedman Foundry & Machine Works, Aurora, Ill.

Chromium-molybdenum iron has been adopted for the gears and tool-carriers because of the sound castings of adequate strength obtainable, and because this iron provides particularly good resistance to wear. Trouble from porosity at the bases of the gear teeth has been eliminated.

The tool-carrier castings are about 74 inches long over all by 37 inches wide at the bottom, and the sections vary from 2 1/2 to 6 3/8 inches in thickness. In this application, the strength of the iron and its structure are the two important factors, because tool-blocks are fastened to the face of the carriers by means of studs. The magnitude and direction of the loads imposed while the tools are cutting are such that the iron must be both close-grained and strong, so that the studs will not loosen. Ready machineability is another factor, as there is considerable surface machining to be done



The Main Drive and Intermediate Gears and the Tool-carriers of the LeBlond Automatic Crankshaft Lathes are Cast from Chromium-molybdenum Iron

and several 4 3/4-inch holes are drilled through the center of the castings. Two of these holes are 28 inches long, and the others are 15 and 20 inches long.

In the case of the hydraulic chuck manifold, the principal requirement is the ability to withstand a constant pressure, the chucks being held against the work under an oil pressure of 1000 pounds per square inch. The iron used for the chucks is of the same analysis as that already given, with the exception that the chromium is omitted. When plain iron was used for the manifolds, rejections due to porosity of the cylinder wall ran as high as 50 per cent, whereas all castings produced from molybdenum iron have passed inspection.....206

To obtain additional information about materials described on this page, see lower part of page 708.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 707 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in June Number of MACHINERY

Roller Chains

LINK-BELT CO., 519 N. Holmes Ave., Indianapolis, Ind. Data Book 1757, containing 174 pages on "Silverlink" roller chain and sprockets for drives and conveyor uses. Many new chains are shown in this book for the first time, outstanding among which is the Twist type chain for service where twisting stress is encountered. Engineering data of value to designers is included, such as formulas and tabular matter for selecting the proper combination of chain and wheels for an efficient drive. Various applications are illustrated. 1

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-432C, 841H, 1283A, 1929A, 2170A, 2630, 2716, 2742, 2822, 2823, illustrating and describing direct-current generators and exciters; magnetic switches; cam-operated master switches; GE Gear-Motors; directional distance relays; dew-point potentiometers for determining the moisture content of gases; cam type drum switches; Pyranol capacitors for low-voltage industrial applications; small panel instruments; and commercial testing instruments. 2

Tool and Drill Steels

A. MILNE & CO., 741 Washington St., New York City. Catalogue on tool and drill steels, including a handy tool steel selector table intended to assist the user in choosing the right grade of tool steel for different jobs. Complete heat-treating instructions follow the description of each type of steel. Circular entitled "Made from a Milne High-Speed Steel," containing brief descriptions of five grades of high-speed steels for cutting tools, and the class of work for which they are especially adapted. 3

Elastic Stop-Nuts

ELASTIC STOP NUT CORPORATION, 1001 Newark Ave., Elizabeth, N. J. Catalogue describing the principle of construction, outstanding features, and applications of the self-locking elastic stop-nut made by this concern. The book also gives the results of tests made of these nuts under severe continuous vibration, and describes their application in the aircraft industry, automotive industry, and many other fields. 4

Silent Engineer

DAVIS BORING TOOL DIVISION OF LARKIN PACKER CO., INC., 6200 Maple Ave., St. Louis, Mo. Bulletin 200, composed entirely of blueprints of Davis tools that are actually in operation in various plants throughout the country. Many new applications of Davis tools are shown which will be of interest to engineers and tool designers in various industries. 5

Counterbores

GOPHER MACHINE & TOOL WORKS CO., 51 Royalston Ave., Minneapolis, Minn., is distributing a card announcing Gopher tool-room counterbores, which also gives a table of approximate spindle speeds for counterboring different materials, as well as a table of clearances between punch and die for different materials. 6

Steels

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. "Steel Buyers' Guide," containing complete listings and descriptions of the wide range of certified steels and allied products carried in stock by the company. Handy reference tables, weight charts, standard specification listings, etc., are included. 7

Rapid-Production Lathes

R. K. LEBLOND MACHINE TOOL CO., Cincinnati, Ohio. Bulletin entitled "Doubling Production per Hour," illustrating and describing the LeBlond four-way 11-inch, and the 16- and 19-inch rapid-production lathes. Typical examples of tooling set-ups designed for these machines are shown. 8

Tempering Furnaces

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Catalogue T-625, illustrating and describing the complete line of Homo furnaces for both production tempering and tool tempering. Many varieties of work are shown being tempered, annealed or normalized in these furnaces. 9

Turret Lathe Tools

WARNER & SWASEY CO., Cleveland, Ohio. 176-page manual and catalogue covering 596 turret lathe tools. In addition to the illustrations and descriptions of the various tools, information is given on the proper application of these tools to secure the most profitable production. 10

Gears and Speed Reducers

D. O. JAMES MFG. CO., 1120 W. Monroe St., Chicago, Ill. Catalogue 150, containing 176 pages covering herringbone, worm, spiral bevel, and spur gear speed reducers, as well as flexible couplings. The book shows the stock ratios assembled from stock parts for immediate shipment. 11

Bakelite Plastics

BAKELITE CORPORATION, 247 Park Ave., New York City. Booklet entitled "The Versatile Service of Bakelite Plastics," outlining the history of modern plastics from the time of their discovery by Dr. L. H. Baekeland up to the present day, and their many applications in industry. 12

Drawing-Room Equipment

ENGINEERING SALES CO., Two Rivers, Wis. Circular covering the Esco line of drawing-room equipment made by this concern, including drawing-board cover magazine,

straightedges and parallel rule attachments, sensitized roll paper dispenser, and erasing shields. 13

Boring Equipment

DAVIS BORING TOOL DIVISION OF LARKIN PACKER CO., INC., 6200 Maple Ave., St. Louis, Mo. Bulletin 300, illustrating and describing the block type boring tool equipment made by the company. The booklet contains engineering data of value to the tool designer and engineer. 14

Control Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa. Folder 94-1, on the Brown pneumatic remote transmission system for the remote transmission of measurement and control in hazardous atmospheres where the use of electric transmission is not permissible. 15

Pipe Cutting and Threading Machines

BEAVER PIPE TOOLS, 600 Dana Ave., Warren, Ohio. Catalogue announcing the Beaver Model B small, portable pipe and bolt cutting and threading machine. Circular illustrating and briefly describing the Beaver line of pipe tools. 16

Super-Micrometer Fly-Cutter Tool

DAVIS BORING TOOL DIVISION OF LARKIN PACKER CO., INC., 6200 Maple Ave., St. Louis, Mo. Bulletin 500, illustrating and describing the new Davis single-point boring tool that can be adjusted accurately to 0.00025 inch on the diameter. 17

Milling Machines

BROWN & SHARPE MFG. CO., Providence, R. I. Catalogue illustrating and describing the important features of design and construction of Brown & Sharpe dual control and standard type milling machines. Complete specifications are given. 18

Electrodes

PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE CO., Monessen, Pa. Booklet covering a new electrode called the "Page Hi-Tensile G," especially recommended for flat and positioned fillet and general flat welding. 19

Safety Chucks

CHICAGO TOOL & ENGINEERING CO., 8389 S. Chicago Ave., Chicago, Ill. Leaflet descriptive of the new Palmgren safety chuck, which is so designed that drills can be changed quickly and safely while the machine is in operation. 20

Hydraulic Couplings

HYDRAULIC COUPLING DIVISION OF AMERICAN BLOWER CORPORATION, 632 Fisher Bldg., Detroit, Mich. Bulletin 3119, illustrating and describing the variable-speed hydraulic coupling for industrial drives, made by this concern. 21

Needle Roller Bearings

NORMA-HOFFMANN BEARINGS CORPORATION, Stamford, Conn. Bulletin 962, descriptive of Norma-Hoffmann precision needle roller bearings and needle rollers, including size and load ratings, application data, and design data. 22

Oil Testing and Purifying Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Catalogue Sections 44-200 and 44-400, describing portable oil testing equipment and oil purifying equipment, respectively. 23

Metal Hose

CHICAGO METAL HOSE CORPORATION, Maywood, Ill. Circular describing the construction of the Avioflex hose, a new type of hose for oil connections, utilizing a multiple cellulose sheet seal over a flexible metal core. 24

Automatic Lubricators

MANZEL BROS. CO., 309 Babcock St., Buffalo, N. Y. Catalogue 94-B, on force-feed automatic lubricators for lubricating the bearings of all types of industrial machinery, as well as engines, pumps, etc. 25

Variable-Speed Transmissions

REEVES PULLEY CO., Columbus, Ind. Circular T-383, entitled "Modern Speed Control Units for Modern

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To Obtain Copies of New Trade Literature

listed on pages 706-708 (without charge or obligation) mark with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	

Name ..... *Position or Title* .....

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Industrial Needs," illustrating and describing the Reeves enclosed-design, variable-speed transmissions. 26

Hydraulic Crankpin Grinders

LANDIS TOOL CO., Waynesboro, Pa. Catalogue N-38, illustrating and describing the Landis 16-inch Type D hydraulic crankpin grinders designed to grind all the pins of a crankshaft with one handling of the work. 27

Electric Socket Instruments

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Booklet B.2136 entitled "Socket Instruments," illustrating installations, applications, and economies of these "plug in" instruments. 28

V-Belts

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Bulletin 6868, describing the construction of Condor whipcord V-belts and showing various installations. 29

Motors

ALLIS-CHALMERS MFG. Co., Milwaukee, Wis. Bulletins 1156-A and 1165-A, illustrating and describing, respectively, polyphase induction motors and bracket-bearing synchronous motors. 30

Magnetic Separators

DINGS MAGNETIC SEPARATOR Co., Milwaukee, Wis. Catalogue 770, dealing with Dings super high-intensity Type IR induction magnetic separators and Dings Type E cross-belt machines. 31

Power Squaring Shears

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Bulletin K, illustrating and describing the Niagara Series K power squaring shears with capacities up to 1/2 inch. 32

Paint

SKYBRYTE Co., Cleveland, Ohio. Catalogue containing information on various types of paint suitable for protecting machinery, metals, concrete, wood, glass, and composition surfaces. 33

Belt Lacer

E. A. ROTTER MACHINERY Co., 3443 N. Western Ave., Chicago, Ill. Leaflet descriptive of the construction and application of the permanent steel belt lacer made by this concern. 34

Balancing Machines

TINIUS OLSEN TESTING MACHINE Co., 500 N. 12th St., Philadelphia, Pa. Bulletin 14, describing Tinius Olsen vibro-electric static-dynamic balancing machines. 35

Portable Electric Tools

INDEPENDENT PNEUMATIC TOOL Co., 600 W. Jackson Blvd., Chicago, Ill. Catalogue covering the Thor line of portable electric tools, including complete specifications and prices. 36

Welding Equipment

LINCOLN ELECTRIC Co., Cleveland, Ohio. Application Sheet No. 60 in a series on machine design, outlining the economies of welded design and practical applications. 37

Monel Gaskets and Pump Parts

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City. Circular entitled "New Life for Old Equipment with Monel Gaskets, Pump Parts, and Valve Trim." 38

Pulleys and Couplings

CONGRESS TOOL & DIE Co., INC., 9030 Lumpkin Ave., Detroit, Mich. Catalogue covering the Congress complete line of pulleys and flexible couplings. 39

Bending Machines

WALLACE SUPPLIES MFG. Co., 1310 Diversey Parkway, Chicago, Ill. Catalogue on Wallace hydraulic motor-driven and hand-operated bending machines. 40

Steam Drop-Hammers

ERIE FOUNDRY Co., Erie, Pa. Bulletin 325, illustrating and describing the design, construction, and operation of Erie steam and air drop-hammers. 41

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 709-722-B is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 709-722-B—or write directly to the manufacturer, mentioning machine as described in June MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 704-705 mark with X in the squares below, the identifying number found at end of each description on pages 704-705—or write directly to the manufacturer, mentioning name of material as described in June MACHINERY.

201	202	203	204	205	206

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Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

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Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

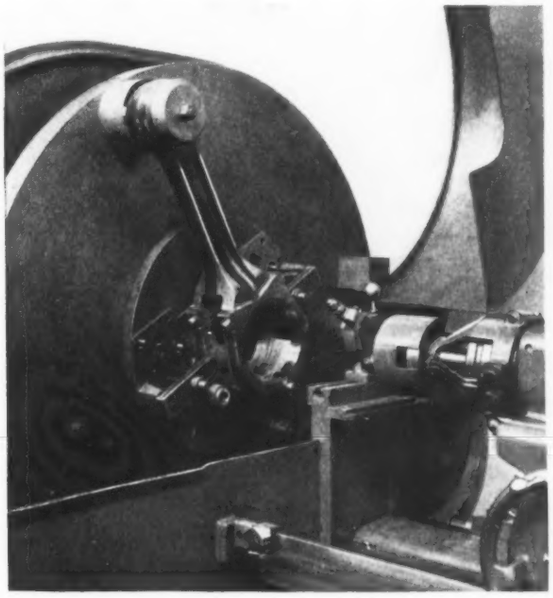


Fig. 1. Heald Gap Type Grinding Machine Equipped for Grinding Diesel Engine Connecting-rods

Heald Adjustable-Gap Internal Grinding Machine

Holes up to 20 inches in diameter can be ground in work up to 42 inches in diameter on the adjustable-gap internal grinding machine recently brought out by the Heald Machine Co., Worcester, Mass. This machine is intended to supplement the smaller well-known gap type machine of this company's manufacture which has a capacity for swinging work up to 36 inches in diameter. The low work-center of the new heavy-duty machine facilitates the handling of heavy or awkward work, including large gears, plates, connecting-rods, housings, and similar parts.

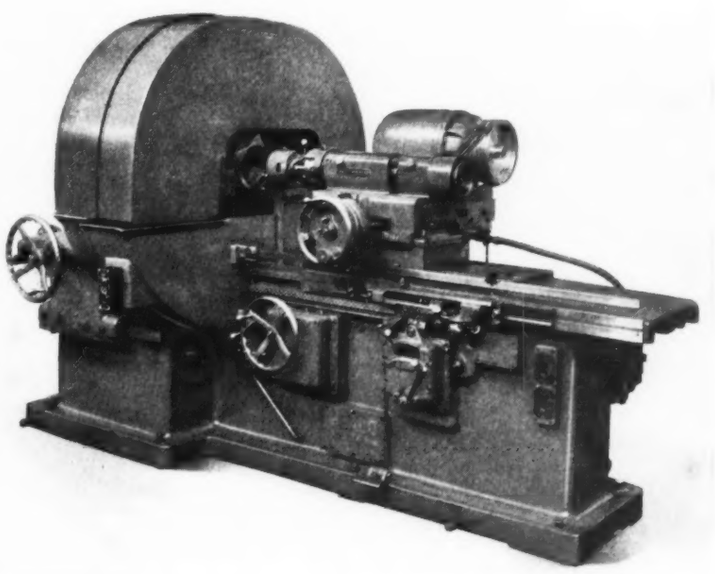


Fig. 2. Heald Internal Grinding Machine with Capacity for Swinging Work 42 Inches in Diameter

The close-up view in Fig. 1 shows how one of these gap type machines has been equipped for grinding all the bearing surfaces on a Diesel engine connecting-rod having a center distance of 22 inches. This machine is equipped with a 50-inch faceplate, 4-inch raising blocks under the work-head, a work-head cross-slide, a special water guard, handwheel table feed, and other special equipment adapted for this particular job. Push-button control switches for the wheel-head and back-shaft motors are built into the base.

The main table travels on flat and vee ways which are protected by two stationary steel shields that completely cover the ways in all table positions. The table is driven by a simple hydraulic arrangement operated by oil under

To obtain additional information on equipment described on this page, see lower part of page 708.

constant pressure. This provides for complete control of speeds and direction of movement. There is an arrangement for quick withdrawal and return. The movement of the table is controlled by three adjustable dogs, two of which are set for the grinding stroke, while the third, in the form of a sliding member, allows the table to withdraw in order to permit the wheel to pass the diamond during the truing operation. Reversal at any point is accomplished by moving a ball-handled lever. The table speeds range from 0 to 32 feet per minute.

The work guard is adjustable for various lengths of work and is opened and closed hydraulically. The guard swings completely back to permit loading from an overhead crane. The work-head stops instantaneously when the stop push-button is pressed. A hole through the spindle permits the use of a tube for operating collets or special holding fixtures of either the draw-back or push type. The hole through the spindle also accommodates a pipe for carrying coolant directly to the work. The gap or swing clearance can be adjusted to suit all types of work by a lateral movement of the bridge and work-head unit on the ways, using a hand-crank which operates the worm and nut.

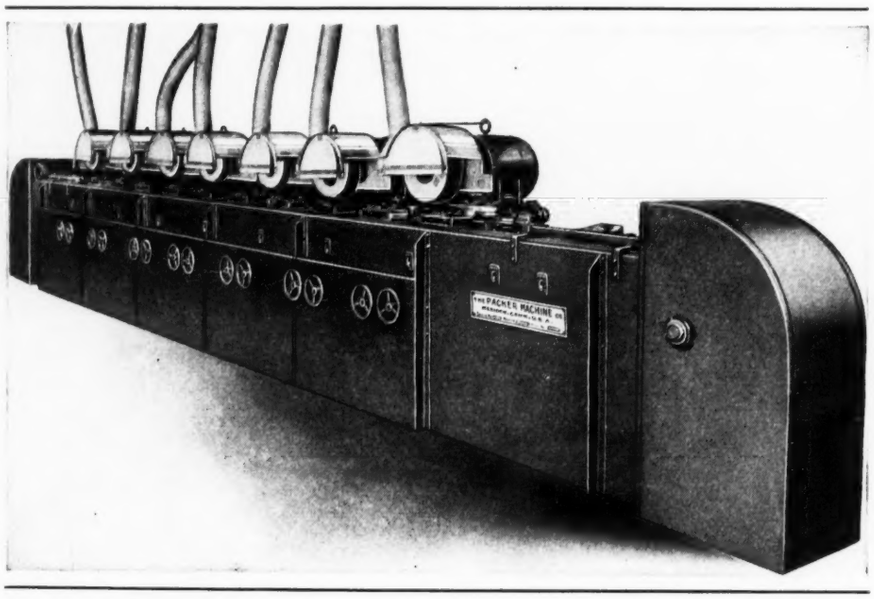
The wheel-truing diamond dresses the wheel just before the finished size is reached. The machine can be set to give the wheel a coarse feed for rough-grinding to within a predetermined limit of the finished size, after which the rate is changed automatically to the finishing feed. The fine feed stop is positioned relative to the size of the work by a knob on the hand-wheel, which makes it possible for the operator to compensate for wheel wear.

The wheel-head is connected by a flexible coupling to an intermediate jack-shaft which is belted to the wheel-head motor. This arrangement eliminates chatter caused by belt pulsations from the wheel-head spindle. Three motors are furnished as standard equipment, a two- to three-horsepower direct-current motor having a speed of 690 to 2070 revolutions per minute being provided for the work-head; a 7 1/2-horsepower alternating-current motor having a speed of 3400 to 3600 revolutions per minute for the wheel-head; and a two-horsepower alternating-current motor having a speed of 1200 revolutions per minute for the pump.

Various attachments can be supplied for this machine, including standard and universal holding fixtures for various sizes of work; faceplates up to 42 inches in diameter; a radius turning device for convex or concave wheel-truing, as required for grinding ball races; cross-slide work-head for face and hole grinding at the same setting; and hand table feed by either a rack and pinion operated by a handwheel or a cam and lever arrangement for use where small movements and a high degree of accuracy are required. The weight of the machine is 16,000 pounds. 51

Packer Automatic Polishing and Buffing Machine

A new straight-line conveyor type automatic polishing and buffing machine adapted for finishing parts of a variety of shapes and sizes has recently been added to the line built by the Packer Machine Co., Meriden, Conn. The design of the machine is such that it is shielded from abrasive dust. The No. 2 machine shown in the illustration is 30 feet 6 inches long by 4 feet 6 inches wide, but this machine can also be furnished in shorter or longer lengths to accommodate any number of wheel-heads.



Packer Automatic Polishing and Buffing Machine Equipped with Straight-line Conveyor Designed to Handle a Variety of Parts

The wheel-heads used on the machine are of the universal type, with adjustments for setting the wheels at any angle from the horizontal to the vertical. The wheel-heads are arranged

To obtain additional information on equipment described on this page, see lower part of page 708.

with spring balance plates which provide a floating action to compensate for any lack of uniformity in the thickness of the work and also to permit finishing work of different thicknesses.

The wheel-heads can be furnished with motors of various horsepower, depending upon the requirements. They can also be supplied with direct-driven wheels or multi-V-belt driven wheel-spindles, which permit changing the speed of the wheels to suit various metals and finishing requirements. The conveyor chain is driven by a variable-speed unit which enables the speed of the conveyor to be changed quickly when required.

All important moving parts are ball-bearing equipped. The carriers to which the work-holding fixtures are fastened travel on a solid machined track, and each carrier is equipped with grease-sealed dustproof ball-bearing rollers. 52

Langelier Four-Spindle Trimming Machine and Two-Spindle Spotting Machine

The horizontal four-spindle continuous cap-screw trimming machine shown in Fig. 1 has been designed by the Langelier Mfg. Co., Providence, R. I., for trimming the heads of socket type cap-screws after the drawing operation. The entire carrier with the four rotating collet type chucks revolves, and a fixed cam operates the cutter levers. The pieces are loaded by hand, and after the trimming operation is completed they are ejected automatically.

Three motors are used on this machine, one for driving the spindles, a second for revolving the carrier, and a third for the lubricant pump which supplies the tools with coolant. The spindles are mounted in Timken bearings, and are stopped by means of a brake at the loading position. All of the working parts operate in a shower of oil. The collet type chucks have interchangeable pads for handling No. 8 to 5/16-inch screws. The speed of the carrier is adjustable for the various sizes of screws, the production rate ranging from 1000 to 1500 pieces per hour. The machine requires a floor space 67 inches wide by 26 inches deep.

The horizontal two-spindle automatic spotting machine shown in Fig. 2 has also been built recently by this company for use in spotting two holes in the oscillating cutter of an electric razor. A standard motor-driven unit with positive cam feed is equipped with a two-spindle attachable multiple head. The unit also drives the work-indexing mechanism which is fed from a magazine. A motor-driven pump mounted in a cabinet base supplies the drills with coolant. The operating cycle is timed for a production rate of 1800 pieces per hour. The machine requires a floor space 22 inches wide by 32 inches deep. 53

GE Welding Electrodes Designed to Meet Boiler Code Requirements

Three new arc-welding electrodes, each protected by a heavy extruded coating, have been announced by the Industrial Department of the General Electric Co., Schenectady, N. Y. These electrodes, designated Types W-20E, W-22E, and W-23E, are intended for the shielded-arc welding of mild steel. The W-20E electrode is especially designed for general-purpose single- or multiple-pass arc-welding of mild steel in any position to

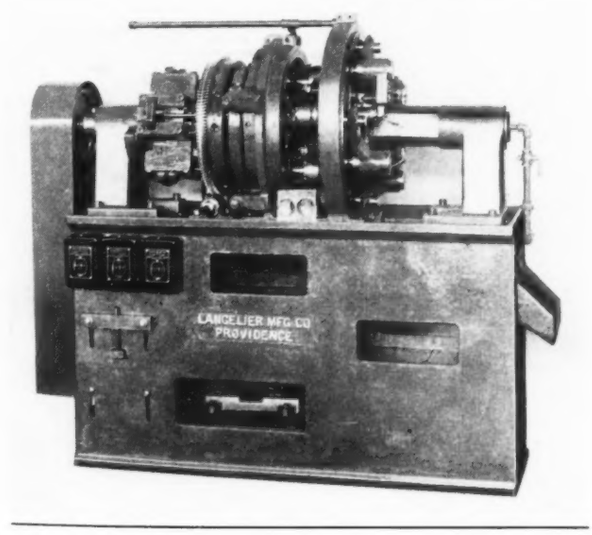


Fig. 1. Langelier Four-spindle Cap-screw Trimming Machine

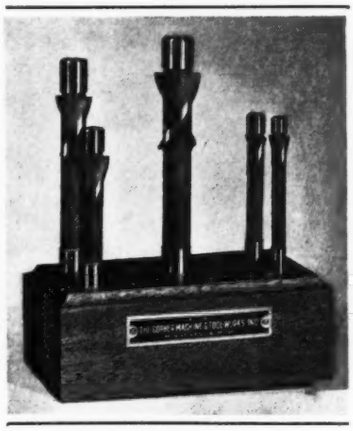
Fig. 2. Two-spindle Automatic Spotting Machine

To obtain additional information on equipment described on this page, see lower part of page 708.

produce shielded-arc quality in excess of that necessary to meet the requirements specified in the A.S.M.E. Boiler Code.

The W-22E electrode is intended for high-quality, single- or multiple-pass arc-welding of steel in any position to produce shielded-arc quality in excess of that necessary to conform with the A.S.M.E. Boiler Code.

The W-23E electrode is designed primarily for high-quality arc-welding of mild steel in the flat position to produce shielded-arc quality in excess of that required to meet the specifications in the A.S.M.E. Boiler Code. As this is a high-current or "hot" rod, the weld metal is quite fluid and washes up well on the side walls of deep-groove joints and fillets. Single- or multiple-pass beads can be made at high speeds without slag inclusions or gas pockets. 54



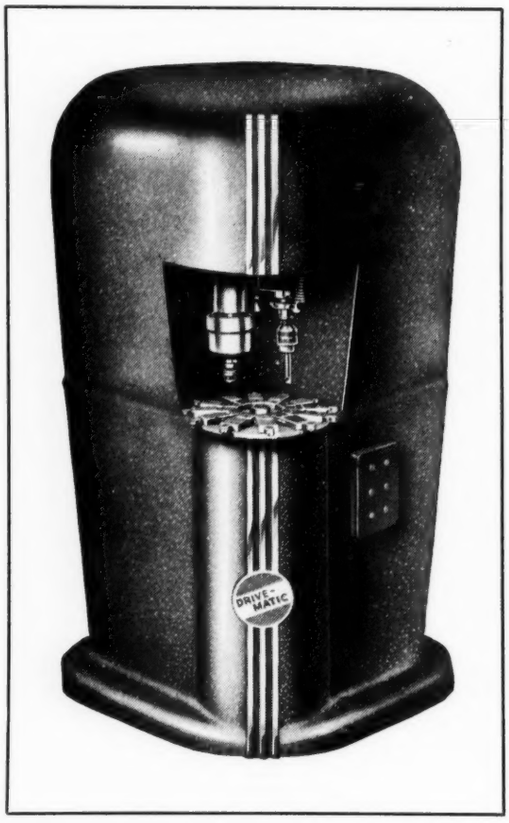
One-piece Counterbores Designed for Tool-room Use

Royce Automatic Drilling and Tapping Machine

A production machine designed primarily to drill and tap small metal parts and fittings automatically has been placed on the market by the Royce Machine Co., 2418 W. Madison St., Chicago, Ill. An outstanding feature of this machine, which is designated the "Double Drive-Matic," is its high speed. According to the manufacturer, this machine completes both drilling and tapping operations at a speed of 1200 per hour. One operation can be performed automatically, if desired, at the rate of 2500 per hour.

The metal piece is dropped into one of the twelve "lock jaw" chucks on the revolving radial dial type turntable as it passes the loading station. It is then indexed automatically to the first station, where it is held securely in place while the drill head is lowered and the hole drilled. The revolving table then indexes to the second station, where the high-speed tapping unit taps a fine sharp thread. The work is finally indexed to the third station, where it is ejected by a blast of air.

An entirely new type of chuck is used on this machine which enables almost any kind and shape of small metal piece, in sizes up to 3/4 inch, to be inserted without using additional fixtures or changing the set-up. The drilling and tapping heads are driven independently by cams. The chucks and heads are synchronized to split-second performance to insure accurate operation. The entire mechanism is enclosed in a housing to afford safety for the operator and to reduce the floor space. 55



Royce "Drive-Matic" for Drilling and Tapping Small Parts at High Speed

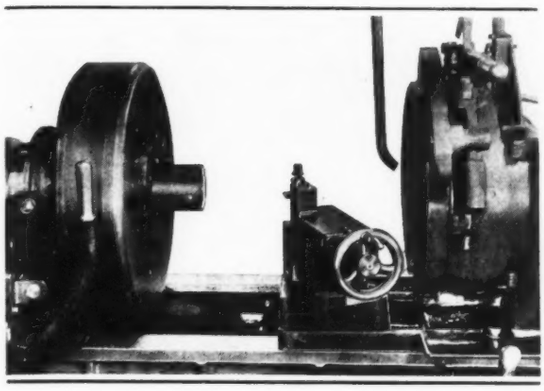
Gopher Tool-Room Counterbores

The Gopher Machine & Tool Works Co., 51 Royalston Ave., Minneapolis, Minn., has just placed on the market a line of tool-room counterbores of the design shown in the accompanying illustration. These counterbores were developed for tool-room work, and were used exclusively on that class of work by the company over a period of fifteen years. They were designed primarily to obtain a fast cutting, easy to sharpen, long-life tool for counterboring standard socket-head screws.

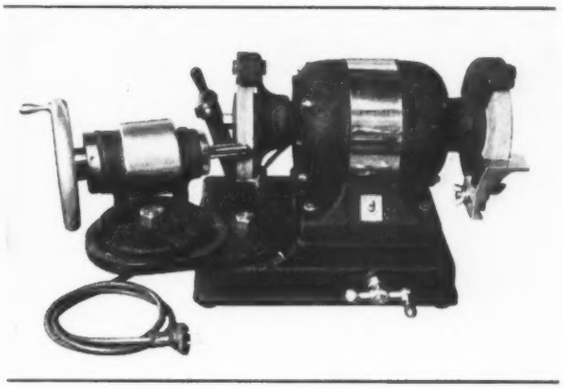
Free or fast cutting action is obtained by the two-lipped construction and the "quick lead" or spiral of the tool blades. One-piece construction, including a solid pilot, is employed to give rigidity and strength to the tool. These features make it possible to "hog out" extremely tough materials.

The sharpening of the counterbores is accomplished in two simple set-ups by grinding the two cutting lips and circular-grinding the two spiral blades. 56

To obtain additional information on equipment described on this page, see lower part of page 708.



Landis Improved Pipe Beveling Tool



Boggis Tap-grinder and Fixture

Improved Pipe Beveling Tool for Landis Threading Machines

The Landis Machine Co., Inc., Waynesboro, Pa., has recently modified the construction of its line of pipe threading and cutting-off machines which are equipped with beveling units. The new beveling unit is placed on the carriage immediately in front of the threading head, as shown in the accompanying illustration, instead of in back of the threading head as on previous machines. With this arrangement, the pipe end overhangs the chuck jaws a relatively short distance. The rigidity thus obtained results in accurate, smoothly finished bevels that are concentric with the thread and that are suitable for high-pressure pipe installations having flanged joints with gaskets which seal against the beveled ends of the pipe.

The beveling assembly is pivoted on a base that is cast integral with the forward projection of the die-head carriage. This base has a graduated scale which shows the inclination of the tool assembly with respect to the center line of the pipe. The tool-holder slide has a dovetail slot which engages a dovetail in the base. 57

Boggis Tap-Grinder and Tap-Grinding Fixture

The "Hybco" tap-grinder and tap-grinding fixture here illustrated has been brought out by Henry P. Boggis & Co., 4500 Euclid Ave., Cleveland, Ohio, for sharpening the chamfer of taps. The complete grinder has a capacity for sharpening taps ranging in size from a No. 4 machine screw tap up to a 1-inch standard hand tap, inclusive. The spindle is hollow and will accommodate pulley and tapper taps. A camming arrangement in the head of the fixture will accommodate taps with two, three, or four flutes, and can be adjusted to give any amount of relief desired. The head is mounted on a swivel base which is graduated for convenience in making angular or taper settings.

The fixture can be adapted for use on standard universal tool grinders. The taps are held in draw collets to insure alignment of taps in which the centers have been destroyed by grinding. An adjustable cam rides against a combination of two, three, or four hardened pins to give the spindle a forward movement when it is rotated. This forward rotating motion, combined with the angle between the axis of the tap and the face of the grinding wheel, produces the relief on the chamfered end of the tap. The amount of relief is controlled by changing the angle of the cam. This feature is very important, as different sized taps and different materials require various types of relief.

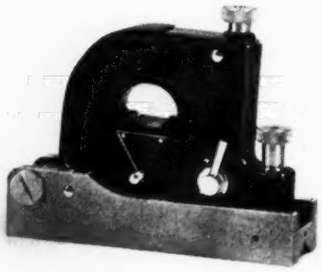
The setting of the pin combinations for two-, three-, or four-fluted taps is accomplished by rotating the knurled selector ring to indicated stops. Setting up of the fixture requires very little time, and various styles of taps can be sharpened in less than one minute per tap. 58

Manhattan Oilproof Air Hose and Wipers for Machine Tools

An air hose for air drills and compressors, constructed with an inner tube of synthetic rubber, has been brought out by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan Inc., Passaic, N. J. This hose is designed to overcome the disadvantages of ordinary rubber air hose when used where oil can enter the system. The G.O.P. (gas-oil-proof) synthetic rubber inner tube is not affected by oil, and, therefore, does not swell or deteriorate. The hose is available in sizes from 1/4 to 2 inches.

This company has also developed oilproof wipers for machine shop equipment, designed to replace the felt wipers used on lathes, planers, grinding machines, turret lathes, milling machines, and other shop equipment. The Monarch Machine Tool Co., Sidney, Ohio, with whom this company's engineers have worked in developing the oilproof wipers, is installing this product as original equipment on their machines. These wipers,

To obtain additional information on equipment described on this page, see lower part of page 708.



Bausch & Lomb Direct-reading Optical Protractor

known as "Paranite," are resistant to the effects of oil, acid, or other liquids, and will not absorb grit or metal chips. They can be molded in sizes to suit the machines on which they are to be used, and are installed to insure close tolerances between moving parts. 59

Bausch & Lomb Improved Optical Protractor

An improved optical protractor for measuring and checking the angular relation between surfaces, edges, and holes has been brought out by the Bausch & Lomb Optical Co., Rochester, N. Y. This instrument is intended for production work and tool-room applications. It does the same work as the sine bar, with the advantage that it offers direct reading, equals the 5-inch sine bar in accuracy, and does not require the accessory equipment necessary in using the sine bar.

Angles to 1 minute of arc can be read directly from the scale, eliminating trigonometrical calculations or reference to handbooks. The base of the instrument is adjustable, making it possible to correct the protractor for inaccuracies from the true level in the bed. A ring center revolves, carrying with it a level vial and protractor scale, which are viewed through an eye-piece. After truing the base, the center ring is merely revolved by hand or by the micrometer screw, which acts as a fine adjustment until the required angle appears on the scale. The protractor is then placed on the work, which is turned until the level bubble is centered. A slotted V-base with a secondary level is provided for making measurements on round surfaces. 60

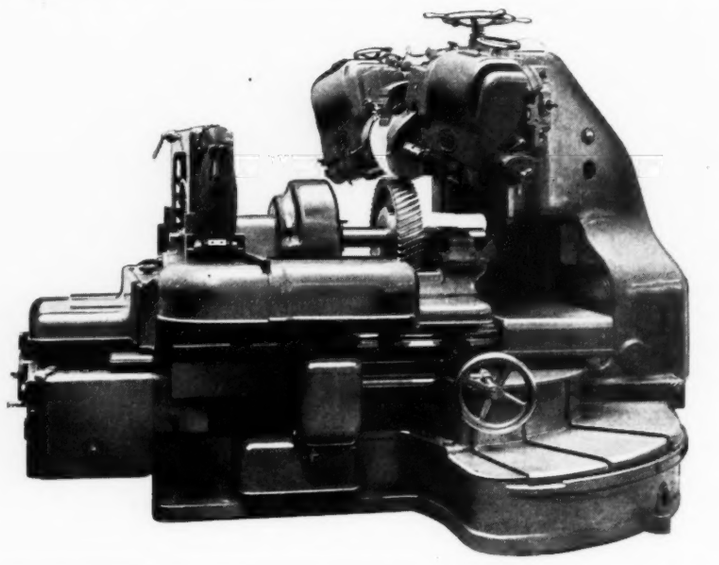
Maag Gear-Grinding Machines

The Triplex Machine Tool Corporation, 125 Barclay St., New York City, has recently been appointed American agent for the Maag gear-grinding machines built by the Maag Gear-Wheel Co., Ltd., Zurich, Switzerland. This company manufactures Maag gear-grinding machines for grinding both helical and spur gears from 12 to 144 inches in diameter.

These machines have been developed to grind the teeth of hardened spur and helical gears at a reasonable production rate without burning the surfaces or producing "hair cracks," and with sufficient precision to permit interchangeability in cases where identical gears for a certain machine are manufactured or machined in different plants.

The new Maag gear-grinding machine shown in the accompanying illustration has a capacity for grinding spur and helical gears up to 24 inches in diameter. Like other Maag gear-grinding machines, this machine operates on the generating method. The motion which produces involute flanks is obtained by a cylindrical pitch block rolling together with the gear blank. The tooth flanks, which are cut with a certain grinding allowance, are moved across the edges of two grinding wheels. The grinding circles of these wheels represent the flanks of a rack which is assumed to be in mesh with the blank. The wear on the grinding wheels is compensated for almost immediately by an automatic device.

Besides the generating motion, the gear blank is given a straight feeding motion in the direction of its axis in such a manner that the grinding disks gradually contact the whole width of the tooth blank. As soon as the flanks of the blank leave the grinding wheels at the end of their straight feeding motion, axial



Maag Gear-grinding Machine for Spur and Helical Gears up to 24 Inches in Diameter

To obtain additional information on equipment described on this page, see lower part of page 708.

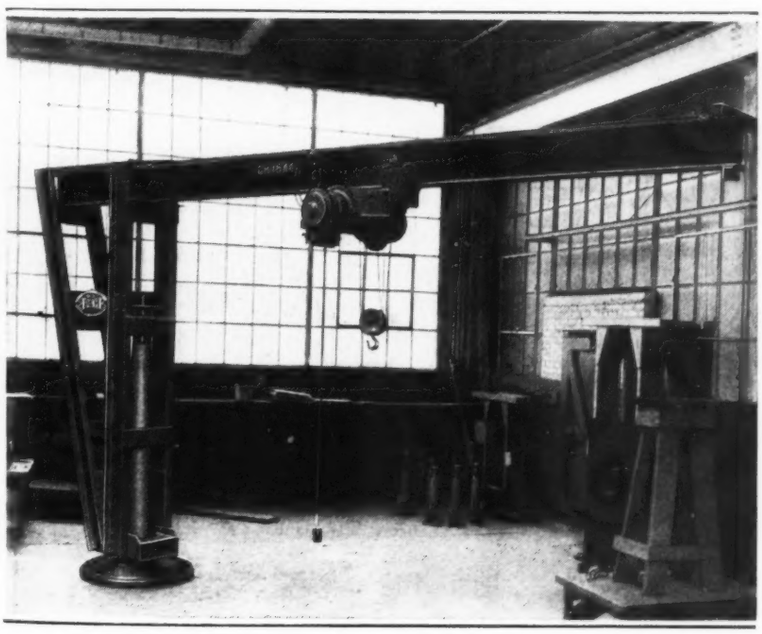
feed is stopped and dividing or spacing takes place automatically. Dividing or spacing is performed after each passage in each direction, or after the return passage, or even after several passages, according to previous adjustments.

Following the dividing or indexing operation, axial feed is immediately resumed. Thus, according to the adjustment of a counting device, this combination of motions is automatically repeated until all the teeth have been ground. After roughing out or rough-grinding the work, the generating motion is stopped automatically in preparation for the finish-grinding operation or to permit measurements to be taken. 61

Self-Supporting Pillar Jib Crane for Use in Confined Areas

A self-supporting pillar jib crane for use in side bays, low head-room areas, and other confined spaces where overhead traveling crane or hoist service is not available or practicable has been brought out by the Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis., in capacities up to 5 tons, heights up to 20 feet, and a maximum working radius of 20 feet. It is adapted for use in machine shops, steel mills, wire mills, canneries, and all types of production plants where materials are lifted, lowered, or moved during the process of manufacture.

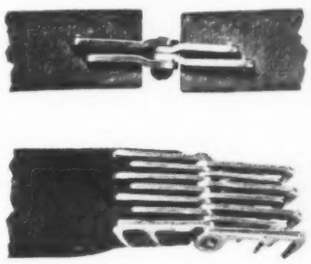
The jib arm of this crane swings on roller bearings. The standard pendant rope or push-button controls can be furnished or the new P. & H. push-button master variable-speed controller, which controls all lifting, lowering, and traveling. 62



Harnischfeger Self-supporting Pillar Jib Crane Designed for Use where Overhead Cranes are not Available

Permanent Steel Belt-Lacer

The ends of either flat or V-type leather or canvas belts can be quickly joined by means of metal belt-lacers made by the E. A. Rotter Machinery Co., 3443 N. Western Ave., Chicago, Ill.



(Above) Application of Steel Belt-lacer to V-belts; (Below) Application to Flat Belts

These lacers are made in any fractional length from 1/4 inch up to 6 inches for fastening flat belts of any width and V-belts of any size, as well as round belts, such as are used on sewing machines. They are made up of metal segments, the number depending upon the width of the belt. Each segment has two hooks shaped as shown in the lower view of the illustration.

After squaring the end of the belt, the round body or joint of the lacer is held against the end of the belt while the hooks are driven into the belt with a hammer. The lower view in the illustration shows a flat belt with a portion of its side cut away to expose the hooks firmly set in the belt.

After fastening both ends of the belt to the lacer, the anchor screw, which joins the segments attached to each end of the belt, is removed in the case of belts over 3 inches wide. A piece of round rawhide is then inserted through the eyes in the segments in place of the screw. For belts less than 3 inches wide, the hole in the last segment is made under size and tapped to receive the threaded end of a screw, as indicated in the illustration.

The four segments used in connecting V-belts are inset and offset, as shown in the upper view of the illustration, to bring the pulling point of the joint into the proper position. The four segments are fastened together by a screw which fits the tapped hole in the segment at one end.

As these metal lacers are ap-

To obtain additional information on equipment described on this page, see lower part of page 703.

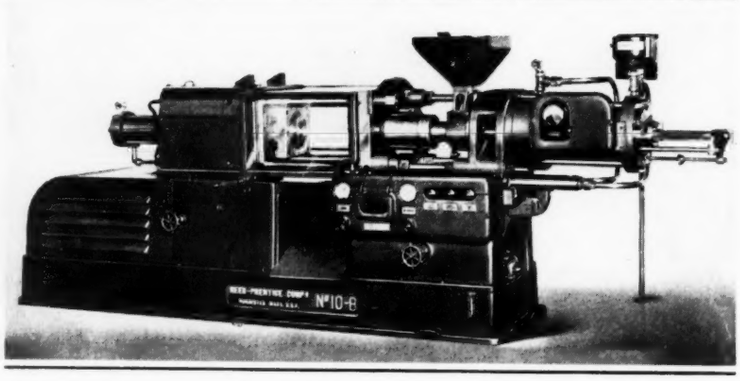
plied only to the outside of a flat or V-belt, they do not come in contact with the pulleys. The ends of the lacers are also placed in far enough from either edge of the belt to prevent them from coming in contact with belt shifters or pulley flanges. 63

Reed-Prentice Automatic Plastic Molding Machine

A No. 10B automatic hydraulic plastic injection molding machine has recently been added to the line of plastic molding machines built by the Reed-Prentice Corporation, Worcester, Mass. This new machine is of larger capacity than preceding models. The capacity of the hopper slide is 20 cubic inches of granulated material, and the molding capacity is 8 cubic centimeters or 6 ounces of molded material. The estimated number of "shots" per hour range up to 300 or 400, varying with the type of product. Pressure on the material can be regulated by a valve, varying from 2800 up to 28,000 pounds per square inch.

The machine can be operated manually or automatically. For manual operation, two levers are employed—the first for closing the mold and the second for operating the horizontal plunger. For the fully automatic cycle, three timing control units are furnished—one for the predetermined period for injection and applying pressure on the material at the end of the stroke; one for timing the solidifying period; and one for regulating the time the molds remain open for ejection of the work. These timing units can be adjusted for any desired time interval from 0.2 second to 120 seconds.

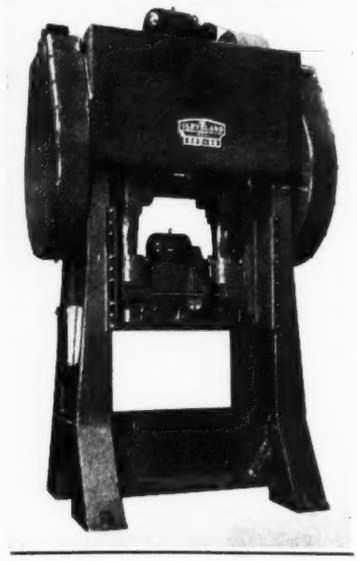
Other features include a positive toggle mechanism which rigidly locks the molds mechanically, so that hydraulic pressure is not depended upon to keep the molds closed. Hydraulic pressure is used to open and close the molds and to operate the plunger. The large capacity pump requires 20 horsepower for a period of only two seconds during the injection cycle and 7 1/2 horsepower for the remainder of the operating cycle. 64



Automatic Hydraulic Plastic Molding Machine Built by the Reed-Prentice Corporation

Cleveland Straight-Sided Double-Crank Press

A straight-sided double-crank press with double back-gears and twin drive, equipped with an electrically controlled hydraulically operated friction clutch, has been brought out by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. This press is designed with a box type crown, in which the intermediate gearing and flywheel are located. All the gears run in oil.



Cleveland Double-crank Press

The front and rear of the press are identical, except for the slide adjusting mechanism, which is power-operated by an individual motor. The slide is pneumatically counterbalanced, the counterbalancing unit being mounted in the uprights. 65

Welding Electrodes

An electrode designated the "Smootharc Harchrome," which is designed exclusively for welding 4 to 6 per cent chromium steel, has been announced by the Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis. This electrode deposits weld metal which has the same properties as the parent metal. It contains from 4 to 6 per cent chromium and 0.50 per cent molybdenum and is made in sizes from 1/8 to 3/16 inch in diameter for operation with currents from 80 to 200 amperes.

Another electrode, known as the "Smootharc Harstain" for welding such brands of stainless steel as Enduro, KA-2, Allegheny Metal, Uniloy, Duroloy, etc., is also announced. This electrode contains 19 per cent chromium, 9 per cent nickel, less than 0.08 per cent carbon, with Columbium added to prevent intergranular corrosion. 66

To obtain additional information on equipment described on this page, see lower part of page 708.

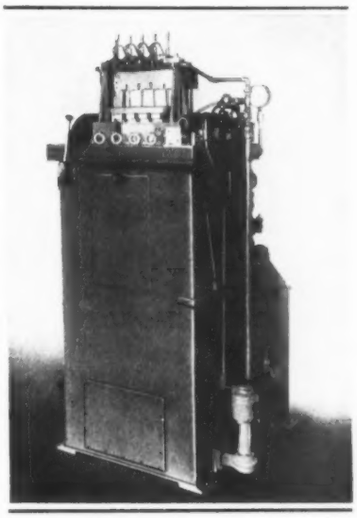
Lapointe Machine Designed for Broaching Small Parts

The Lapointe Machine Tool Co., Hudson, Mass., has just announced a new type of broaching machine which can be equipped to perform a great variety of broaching operations on small parts at high production rates. This machine, equipped with a hydraulically operated fixture as shown in the accompanying illustration, cuts the keyways in silent chain drive sprockets, four at a time, and simultaneously stamps the customer's trademark and a zero locating point on the sprockets at the rate of 1000 parts per hour. The zero point is thus located in the correct position with respect to the keyway.

The machine, known as the Type SPD 5-20, has a welded steel frame. The main operating cylinder is located directly under the platen and actuates a vertical slide, to which are attached the four pullers for the broaches. The maximum pull-down capacity is 5 tons, and the maximum travel of the slide 20 inches. A direct-connected, motor-driven hydraulic pump provides a constant broaching speed of 31.5 feet per minute. Other speeds are obtained by using pumps of various sizes.

The machine is installed in a pit for convenient operation. Both foot-pedal and hand-lever controls are provided for operating the main ram, and hand-lever control is provided for operating the fixture. The fixture opens automatically at the end of the down stroke and the broached parts are ejected from the workholders. New parts are then placed in the fixture, which holds them in such a position that the broaches do not come in contact with the work on the return stroke. Hydraulic interlocking plungers prevent the main control handle from being moved until after the fixture is opened and also prevent the handle that starts the broaching stroke from being moved until after the fixture has been closed and the parts are in their proper positions for broaching.

The marking operation is performed by a "load and fire" arrangement. A cam plunger at the left of the fixture releases the four marking plungers, allowing preloaded springs to bring the plungers down with sufficient force to mark the work after it has been dropped into the broaching position. 67

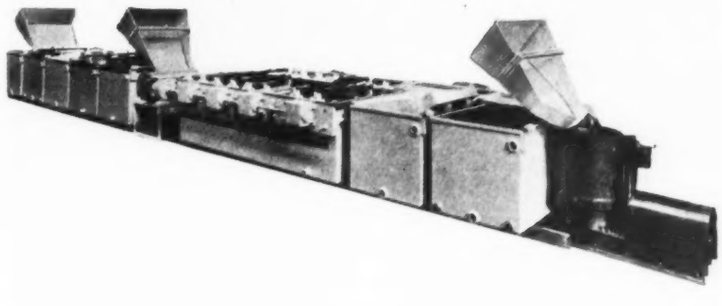


Lapointe Pull-down Broaching Machine with Fixture for Cutting Keyways in Sprockets

Hopper Type Barrel Plating Equipment

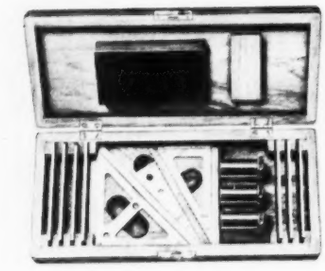
A complete barrel plating assembly, consisting of rinse tanks, plating tanks, and a Mercil centrifugal drier, has been developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J. This equipment was designed with a view to lowering production plating costs, insuring proper control of treatments, giving larger production capacity in a small floor space, lowering maintenance cost, and permitting the segregation of various classes of small batches of work.

Work that has previously been ball- or sand-rolled is dropped into the hopper of the first tank of this equipment, where it receives a cold water rinse. It then proceeds from one hopper to another through a cleaner, a cold water rinse, an acid dip, another cold water rinse, and then to an empty plating barrel cylinder. After being in the plating tank for the required time, the work goes from one hopper to another through a cold rinse, then a hot rinse, and finally into the Mercil type centrifugal drier, where all the moisture is removed. From the drier, the work is dropped into a suitable handling receptacle. Each tank has an individual motor drive and limit switch. This permits the addition of as many hopper units as required, depending upon the number of treatments. The entire assembly is controlled automatically from a master panel board. 68



Complete Barrel Plating Equipment Built by the Hanson-Van Winkle-Munning Co.

To obtain additional information on equipment described on this page, see lower part of page 708.



Taft-Peirce Gages for Measuring Angles from 0 to 180 Degrees

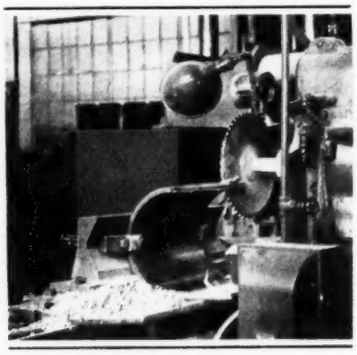
Taft-Peirce Universal Angle Gages

A complete set of gages for accurately measuring and laying out any angle between 0 and 180 degrees by five-minute increments is being introduced by the Taft-Peirce Mfg. Co., Woonsocket, R. I., for use in toolrooms, die shops, and manufacturing and inspection departments. This set of gages comprises ten independent angle gages, seven of which are parallel blades with a pair of supplementary angles on each end, and three of which are triangles.

All gages are made of tool steel, hardened and ground to such precision that the variation from the exact angle of any combination will not exceed one minute. The universal angle members are fixed or held in any combination for convenient handling by an ingenious clamping device, three of which are provided in each set, as indicated in the accompanying illustration of the complete set of gages arranged in a convenient case. 69

Huther Circular Saw for Cutting Non-Ferrous Metals and Plastics

The Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y., has developed a circular saw having tungsten-carbide tipped teeth for cutting non-ferrous metals, fibers, and plastics. The saw is made in segments, five teeth to a segment, each tooth being tipped with a Firthite sintered-carbide tip manufactured by the Firth-Sterling Steel Co., McKeesport, Pa. In case of damage to a tooth, the segment can be replaced quickly.



Huther Saw with Carbide-tipped Teeth Cutting Laminated Plastic

In the illustration is shown a saw 11 inches in diameter, with a 7/16-inch face engaged in cutting Micarta laminated plastic material for steel-mill bearings. The operation consists of cutting the material lengthwise to the proper segment arc. The bearing has an inside diameter of about 12 inches, a 3/4-inch wall, a length of 12 inches, and a segment length corresponding to an arc of 135 degrees. 70

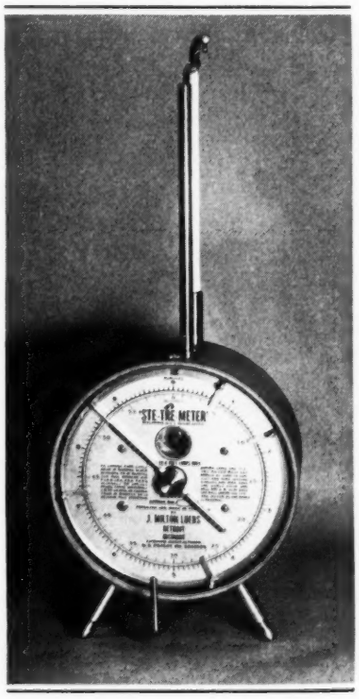
Ste-Tre-Meter for Accurately Timing Heat-Treating Operations

A timing instrument, designated the "Ste-Tre-Meter," constructed entirely of non-ferrous metals and stainless steel, for accurately timing heat-treating and similar operations, is being placed on the market by J. Milton Luers, 3211 Bellevue Ave., Detroit, Mich. This instrument can be attached permanently to a furnace or it can be supplied for portable use as a self-contained unit which can be plugged into a 110-volt, 60-cycle, single-phase circuit light socket. The electrical equipment that drives the timing mechanism is designed to operate for years without lubrication or attention. 71

Westinghouse Push-Button Stations and Line Starters

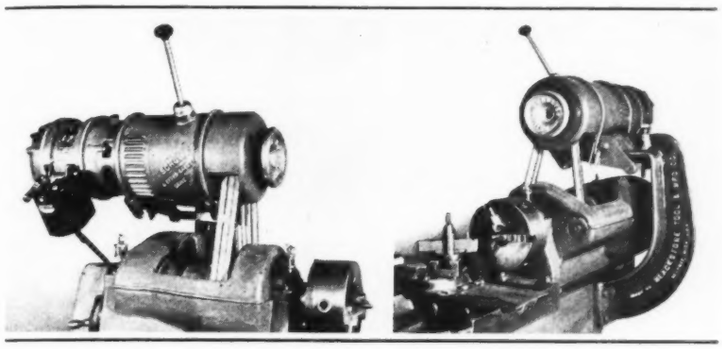
Dust- and water-tight heavy-duty push-button stations for use where protection from fumes, dust, and moisture is desired have been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These stations are suitable for operation where high control currents of magnetic controllers for large motors must be withstood for long periods of time and where reliability is of prime importance. They are made of heavy cast iron, finished with weather-proof aluminum paint, and are available in types having from one to four units. The mounting holes are on the outside of the case, the cover is sealed with a cork gasket and oil-treated paper, and rust-resisting materials are used throughout.

The heavy-duty HD push-button stations made by this company are now available with mushroom type operating heads for use where it is more con-



"Ste-Tre-Meter" Designed for Timing Heat-treating Operations

To obtain additional information on equipment described on this page, see lower part of page 708.



Front and Rear Views of Schultes Motor Drive Attached to Lathe

venient for the operator to close or open a circuit by means of his elbow. This type is especially suited for use as an emergency stop-button station, since it can be operated easily and quickly.

Another recently announced product of this company is the "De-Ion" line starter for alternating-current motors up to 5 horsepower, 220 volts, and 7 1/2 horsepower, 440-550 volts, in an over-size cabinet which provides an unusual amount of wiring space and can be used where over-all dimensions are not limited to the more compact standard sizes. These starters can be obtained with separate push-button, with built-in start-stop push-button, and with built-in hand-off-automatic switch. 72

Schultes Motor Drive for Machine Tools

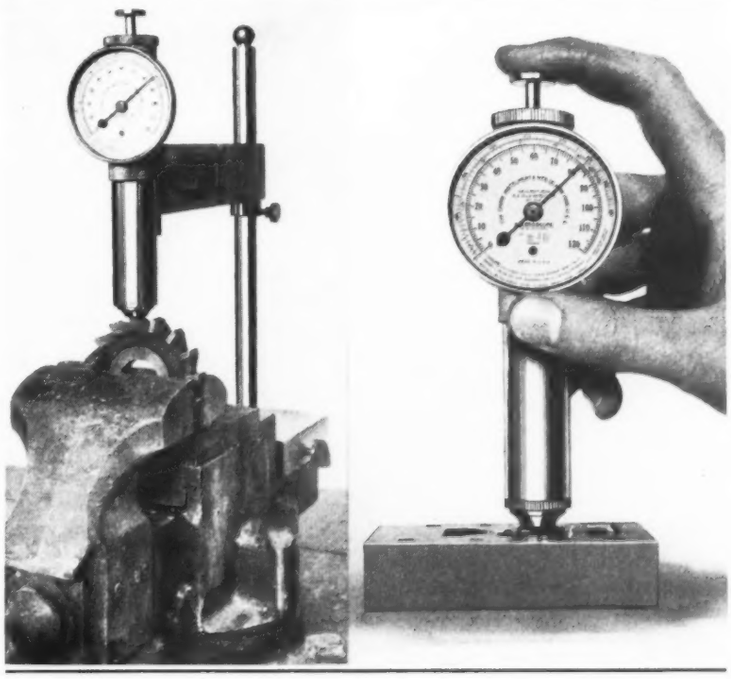
The Blackstone Tool & Mfg. Co., 10541 Gratiot Ave., Detroit, Mich., has placed on the market the Schultes motor drive, suitable for use on all types of machines, including lathes, shapers, milling machines, drill presses, planers, etc., in place of belt drives. The entire motor unit can be revolved in its cradle to bring the gear shift lever into any desired position. A hand-wheel is provided at the end of the unit, as shown in the view to the left in the accompanying illustration, to enable the operator to revolve the spindle of the machine by hand when setting up or adjusting tools.

A hand-operated screw arrangement is provided for adjusting the belt tension. Hardened and ground splines and gears operate in an oil bath encased in a dustproof and leakproof housing. Power from a small motor is transformed through rugged gearing to a slow-speed heavy-duty drive. The unit is designed to facilitate attachment to any type of machine, and is reversible in the cradle for left- or right-hand drives.

One lever controls the four speeds. Instant reversibility is possible with all four speeds. The unit is adapted for flat-belt, V-belt, chain, or direct drive. In cases where eight speeds are desired, a two-speed motor can be used. These units are regularly made in seven sizes, ranging from 1 to 10 horsepower, with output speeds ranging from 160 to 1200 revolutions per minute. 73

Toolmaker's Pocket-Size Hardness Tester

A pocket-size indicating hardness tester has been designed by the Shore Instrument & Mfg. Co., Inc., 9025 Van Wyck Ave., Jamaica, N. Y., following somewhat the same lines as the Model "D" dial indicating scleroscope. In making hardness tests, the instrument is placed on the work and the button on top of the barrel is pressed down. The pointer automatically indicates the hardness on an enclosed scale. The instrument proper is only 6 inches long and weighs about 1 pound. With suitable attachments, tests can be made



Examples of Hardness Testing with Shore Pocket-size Tester

To obtain additional information on equipment described on this page, see lower part of page 708.

in a bench vise or on a surface plate, as well as free-hand.

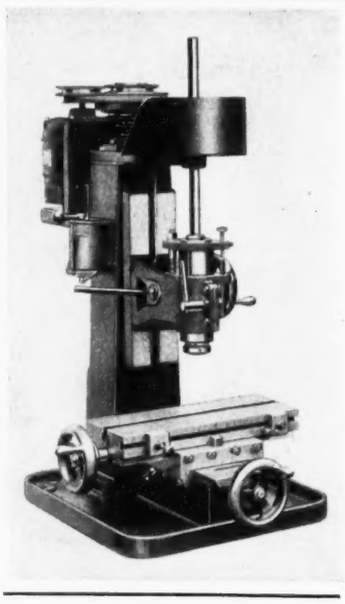
The view to the left in the accompanying illustration shows the instrument and attachments employed in testing the hardness of a milling cutter clamped in a bench vise. The view to the right shows how the instrument is used free-hand for testing the hardness of a die-block.

This hardness tester is so designed that it can be operated as rapidly as an automatic center-punch. It has the same Shore-Brinell conversion hardness scale as that used on the larger model. A diamond-pointed hammer is used, together with an improved clutch mechanism. 74

Linley High-Speed Vertical Bench Milling Machine

A high-speed vertical bench milling machine with a screw-fed micrometer quill, has been brought out by the Linley Bros. Co., 11 Montauk St., Bridgeport, Conn. A 10-pitch screw, running parallel and attached to the quill flange at its upper end, serves as the feeding member for the quill. A bronze nut which fits the screw and which has spiral teeth on the outside meshes with a ground spiral gear keyed to a horizontal shaft carrying the handwheel. This handwheel is equipped with a dial 2 1/2 inches in diameter having 0.001-inch graduations and a vernier reading to 0.0001 inch.

A depth stop-gage located in front of the quill is graduated with ten lines to the inch. One turn of the handwheel moves the quill 0.100 inch or one space on the graduated scale. The total quill travel is 3 inches. The spiral gears are adjustable diametrically and endwise to remove backlash. The weight of this machine is 430 pounds. 75



Linley Bench Milling Machine with Micrometer-fed Quill

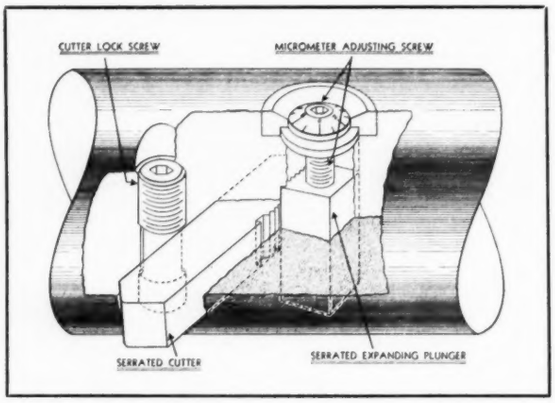


Diagram Showing Construction of Davis Fly Cutter with Micrometer Adjustment

Davis Fly Cutter with Micrometer Adjustment

The "Super Micrometer" fly cutter here illustrated was originally designed by the Davis Boring Tool Division of Larkin Packer Co., Inc., 6200 Maple Ave., St. Louis, Mo., for camshaft and crankshaft boring in cases where extreme accuracy is required. It has been found, however, that this tool can be used to advantage for many other boring jobs requiring a high degree of accuracy. The tool has only three moving parts—the adjusting screw, the serrated expanding plunger, and the cutter.

The serrated plunger is threaded internally and works up and down on the adjusting screw, which is actuated from the micrometer dial at the top. The serrations on the plunger mesh with serrations on the cutter, the arrangement being such that raising the plunger expands the cutter, and depressing it contracts the cutter. The tool can be made with as fine adjustment as required, 0.0001 inch expansion per graduation being available, if desired. The fine adjustment, however, does not affect the wide range of sizes for which the cutter can be set by simply removing the plunger and engaging the serrated members to suit requirements.

The direct thrust of the boring cut is taken on the hardened and ground serrations, and not on the adjusting screw. This construction eliminates the possibility of slipping and insures accurate results. The plunger and cutter are made close plug fits in their respective slots to give the desired rigidity and prevent the entrance of chips and other foreign particles. 76

Carson Electronic Micrometer

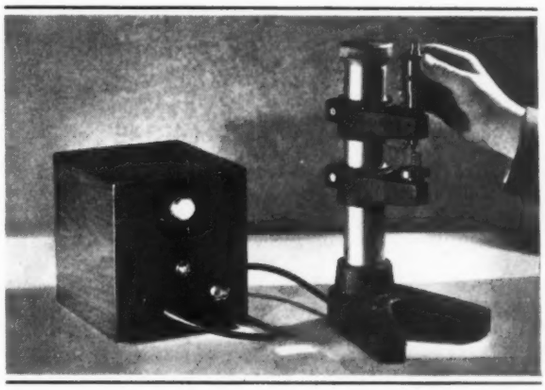
The making of measurements to within 0.00005 inch with no contact pressure and no human element involved in setting the micrometer are features of the Carson electronic micrometer, made by the Instrument Specialties Co., 70 Paterson Ave., Little Falls, N. J. The complete instrument consists essentially of an adjustable work-table and micrometer head, supported by a stand and column. Electrical connections from the stand are plugged into a small cabinet containing the electronic unit. On the front of the cabinet, a bull's-

To obtain additional information on equipment described on this page, see lower part of page 708.

eye lens glows the instant metal-to-metal contact is made between the sharp micrometer point and the surface being measured.

Because of the special electronic circuit employed, the sharp micrometer point does not pit or mar the surface being measured. Positive indication of contact is given before the sharp point penetrates the surface. No skill or experience is required to obtain accurate readings. With a drum of large diameter on the micrometer head, direct readings to less than 0.00005 inch are quickly and positively obtained.

Precise measurements of the free length of flat or coil springs or their lengths under load can be made with this instrument without the measuring operation exerting any load on the springs. Measurements can be made against highly polished surfaces, ball bearings and races, and gages and mirror surfaces without marring the work. Soft and ductile materials, such as thin copper or aluminum sheets, can be accurately gaged without deforming the metal. Dimensions of fine wire, foil, and small parts such as are used in watches and precision instruments are easily measured. Non-conducting materials are handled by measuring against a steel plate. 77



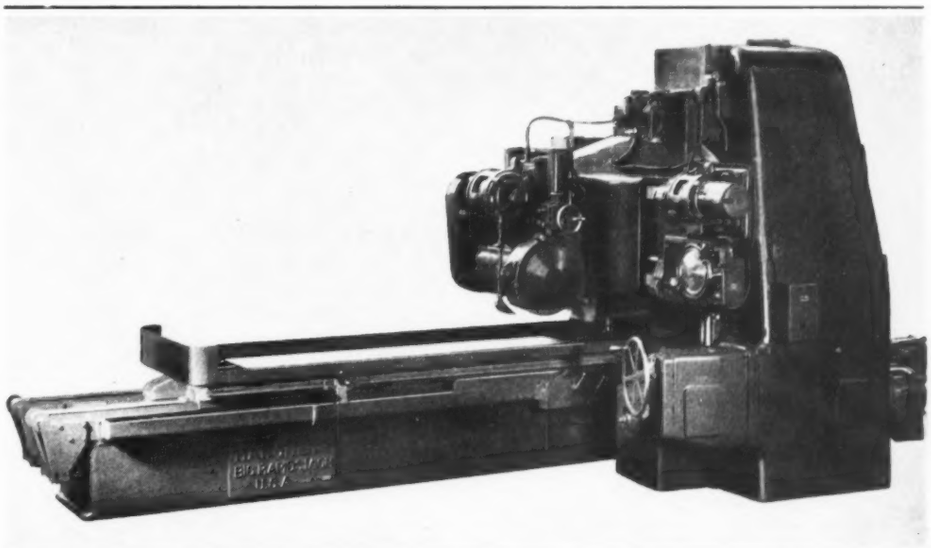
Carson Electronic Micrometer for Precision Measuring to 0.00005 Inch

Hanchett Planer Type Surface Grinding Machine

A new planer type grinding machine has been brought out by the Hanchett Mfg. Co., Big Rapids, Mich., which is designed along the same general lines as the machine described on page 631 in May MACHINERY. The new machine is smaller in size, however, and is equipped with a grinding wheel head having a horizontal instead of a vertical spindle. The work-table has a finished surface 30 inches wide by 96 inches long. The table speeds range up to 90 feet per minute. The ways are lubricated by a forced-feed system.

The grinding wheel is of the straight-wheel type, 20 inches in diameter with a 3-inch face and a 10-inch center hole. The distance from the wheel to the table top, measured under a new wheel of this size, is 20 inches. The cross-rail has power elevation at the rate of 5 feet per minute. Hand-clamps are provided for both the main and auxiliary housings. The wheel-head has provision for both automatic and hand operated down feed. Automatic cross-feed is available in steps of 1/8 inch to 5 inches. The constant cross-feed is at the rate of 30 feet per minute. The coolant system is equipped with a 250-gallon tank.

A 15- to 20-horsepower motor having a speed of 1200 revolutions per minute is used to drive the grinding wheel. The hydraulic pump is driven by a 10-horsepower motor running at 1200 revolutions per minute, and a 5-horsepower high-torque motor drives the cross-feed of the grinding wheel head. Elevation of the entire cross-rail assembly is accomplished by means of a 3-horsepower motor equipped with an automatic brake. The coolant pump is driven by a 1/2-



Hanchett Planer Type Surface Grinding Machine with Horizontal Spindle

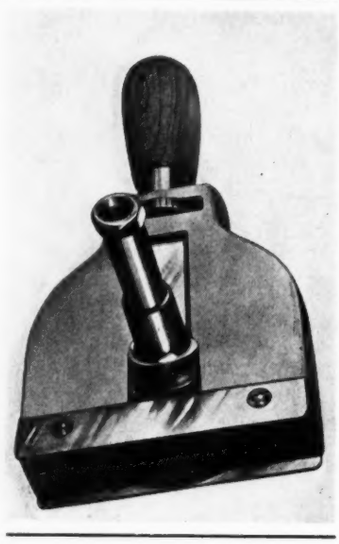
To obtain additional information on equipment described on this page, see lower part of page 708.

horsepower motor, and a 1/4-horsepower motor drives the mechanism of the forced-feed lubrication system. The machine weighs approximately 45,000 pounds. The over-all dimensions are 10 feet 10 inches wide by 23 feet long by 9 feet high. 78

Stevenson Rotary Plane

A light-weight portable grinding wheel known as the Stevenson "rotary plane," which is designed for use in garages, machine shops, and foundries, is being manufactured by the Hardware Specialty Co., Withee, Wis. This tool comes equipped with a regular 1/2–20 thread arbor to fit standard flexible shafting designed to be driven by a 1/2-, 1/3-, or 1/4-horsepower motor running at a speed of 3400 revolutions per minute. Standard equipment includes one extra 3/4- by 4-inch grinding wheel and an adjustable wheel-dresser.

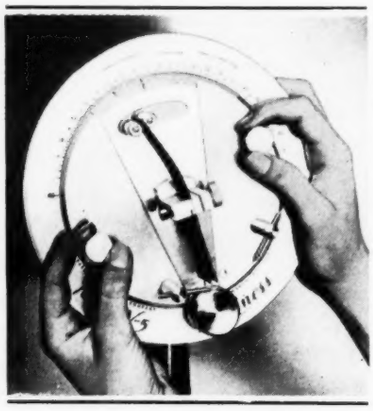
This tool is adapted for grinding down welds, obtaining a smooth finish on automobile bodies and fenders before painting, and for various other grinding jobs. The grinding wheel can be raised or lowered by means of an adjusting nut calibrated to 0.0005 inch. 79



"Rotary Plane" Equipped with 3/4- by 4-inch Grinding Wheel

Taber Stiffness Testing Instrument for Light Sheet Materials

An instrument for determining the initial and normal stiffness and also the resilient or spring-like qualities of light metallic sheet and wire materials, paper, and coated fabrics, and a "triple-cut" shear for blanking out test specimens from sheet materials to be tested, have been brought out by the Taber Instrument Co., North Tonawanda, N. Y. The "triple-cut" shear is



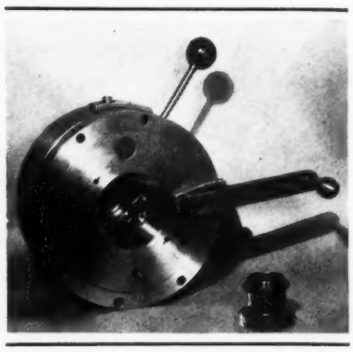
Taber Stiffness Testing Instrument

an important accessory to the stiffness gage, as it blanks out test specimens accurately to size, thus insuring uniform results in comparing specimens.

Both the testing instrument and the shear for blanking out test specimens are light and portable, and can be used anywhere in the laboratory, office, or plant. Accurate readings can be made quickly and easily, even by those without previous technical experience. The instrument has metric calibrations, with a continuous scale covering a range of from 0 to 2000 gram centimeters. 80

Garrison Duplex Chuck for Cluster Gears

The outstanding feature of a duplex chuck recently brought out by the Garrison Machine



Garrison Duplex Chuck for Cluster-gear Units

Works, Inc., Dayton, Ohio, is the provision for chucking on any two gears of a cluster-gear unit instead of using the conventional method of locating the cluster-gear unit by the two end gears. With this arrangement, the gear manufacturer can utilize the two most important gears of the cluster for locating and chucking purposes, regardless of their size or position. This assures finishing the bore true with the important gears of the cluster.

The duplex chuck illustrated makes it possible to chuck the two-step cluster gear and clutch-tooth unit shown in the lower right-hand corner of the illustration on the large end of the cluster and the small middle gear, even though the clutch tooth collar is larger than the small middle gear and located very close to it.

The complete chucking can be accomplished in approximately eight seconds, while the unloading requires slightly less time. Eccentricity can be held to the same precise tolerances as on ordinary gears. The chuck can be mounted on a machine adapter or a faceplate. All operating handles are removed when the chuck is used on a rotating machine spindle. 81

Carron Electric Marking Tool

An electric marking tool called the "Engrav-rite," which is designed to produce permanent

To obtain additional information on equipment described on this page, see lower part of page 708.